

Circuit Training

Short Circuit Your Workout

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What is Circuit Training

- Performing exercises one after another with little or no rest between
- Can be done with any form of resistance
- Is made of interval structure
- Has sets, reps, rest and total volume
- Should be planned ahead of time to maximize performance adaptation

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Why Circuit Train

- Time restricted training sessions can still see very good benefit
- Increased energy demand improves strength and endurance simultaneously
- Similar to sporting event activity where rest time is limited
- Fun, challenging, and can be performed with large groups

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Volume for Circuits

- Look for fatigue markers
 - Technique or skill breakdown
 - Heavy breathing
 - Slowing down
- Increase as client becomes more fit
- No more than 3 minutes "on" without rest or client will not get a chance to recover and adapt
- Change up movement patterns
 - Keeps recruitment of muscle fiber maximal
 - Improves rate of fuel usage and clearance of waste
 - Keeps client motivated and challenged and gives "automatic goals" to reach for future workouts

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Circuit Training Science

Muscular Endurance Conditioning

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Energy Metabolism

Which System(s) is/are Being Used?

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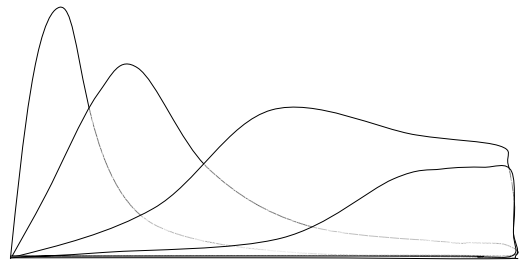
THE CLASSIC CONCEPT

Creatine Phosphate.....6 - 15 sec
 Anaerobic Glycolysis.....30sec - 2min
 Aerobic Metabolism.....>20 - 30 min

WHAT'S WRONG WITH THIS CONCEPT?

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THE ENERGY CONTINUUM



Creatine Phosphate Aerobic Glycolysis
 Anaerobic Glycolysis Beta Oxidation of Fat

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THE ENERGY CONTINUUM

WHAT DICTATES THE ENERGY SYSTEM THAT WILL BE USED?

- The Work Rate or Rate of Energy Consumption
- Substrate Concentration
- Biochemical Machinery

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CLASSIC VIEW OF THE PHASES OF THE INTERVAL CYCLE

WORK PHASE:

- Creatine Phosphate (CP) levels go down.
 High intensity work uses a greater proportion of the fastest system (CP) and levels become proportionally reduced.
- Lactate levels go up.
 High intensity work dictates greater use of sugar anaerobically (anaerobic glycolysis) and the production of its waste product, lactic acid.

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CLASSIC VIEW OF THE PHASES OF THE INTERVAL CYCLE

RECOVERY PHASE:

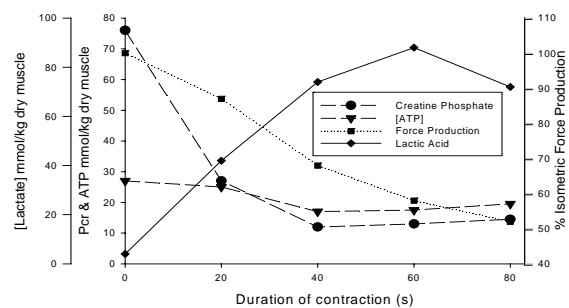
- Lactate levels go down.
 Low intensity work allows the use of lactic acid as a fuel, its removal is responsible for the production of the energy used for recovery.
- Creatine Phosphate (CP) levels go up.
 The energy produced by the breakdown of lactate and the other fuel sources (carbohydrates and fats) is used for the re-synthesis of CP.

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THE ENERGY CONTINUUM

Relative changes in substrates and products

ATP HOMEOSTASIS



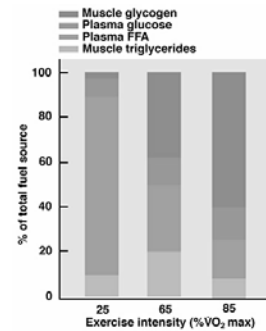
Effect of Event Duration on Primary Energy System Used

Duration of event	Intensity of event	Primary energy system(s)
0-6 s	Very intense	Phosphagen
6-30 s	Intense	Phosphagen and fast glycolysis
30s - 2 min	Heavy	Fast glycolysis
2-3 min	Moderate	Fast glycolysis and oxidative system
> 3 min	Light	Oxidative system

Table 5.3 from *Essentials Of Strength and Conditioning*

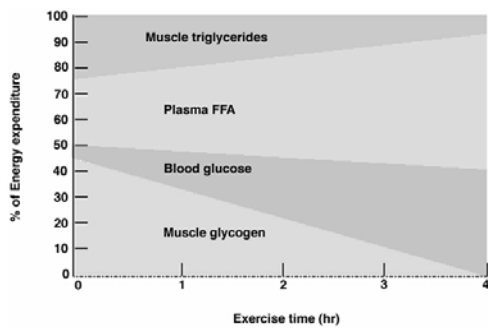
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Effect of Exercise Intensity on Muscle Fuel Source



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Effect of Exercise Duration on Muscle Fuel Source



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IMPLICATIONS FOR METABOLIC CONDITIONING

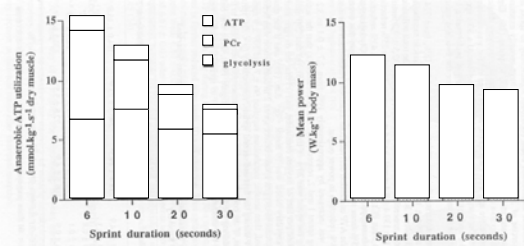
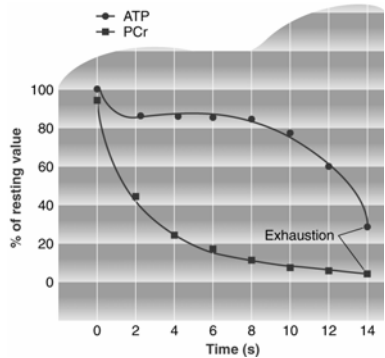


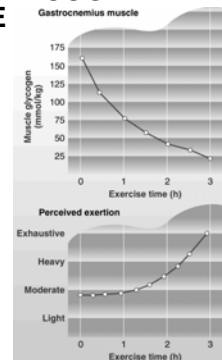
Figure 19.3 Utilization of ATP derived from anaerobic metabolism and mean power output during maximal sprint cycling of 6-, 10-, 20-, and 30-s duration (6 s: n = 8, 10 s and 20 s: n = 8, 30 s: n = 16; all males). Data for 6-s sprints from Gaitanov et al. 1993 (13); data for 10- and 20-s sprints from Bogdanis et al. 1994 (9); data for 30-s sprint from Bogdanis et al. (9) and Bogdanis et al. 1994 (10).

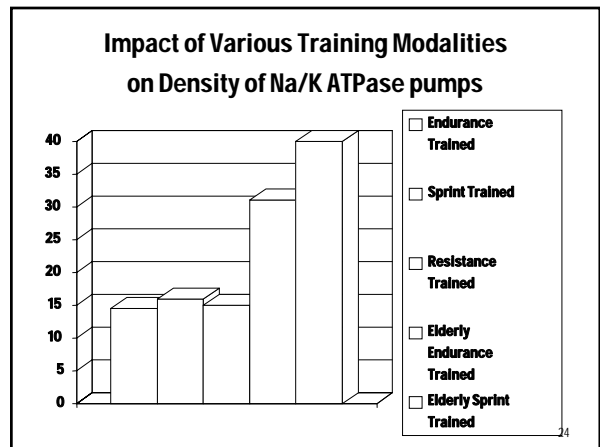
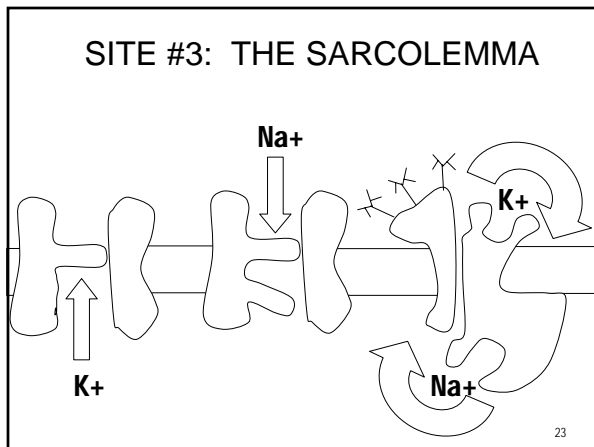
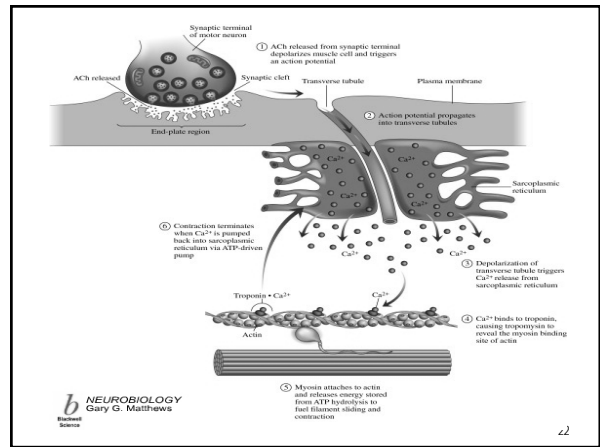
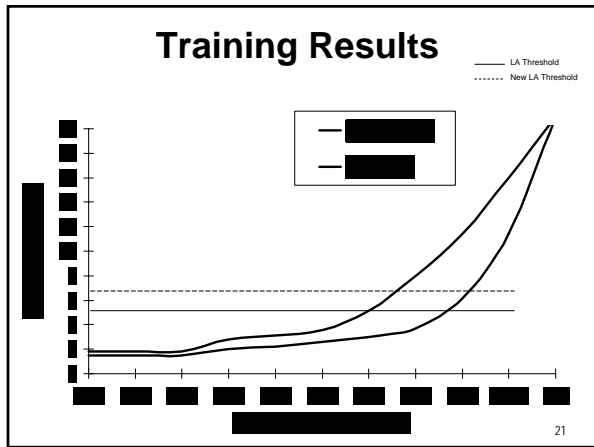
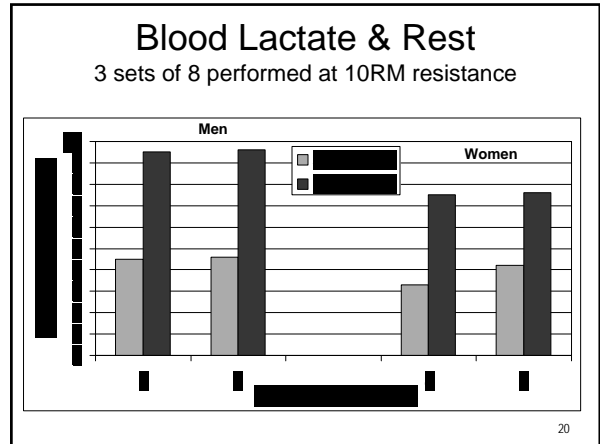
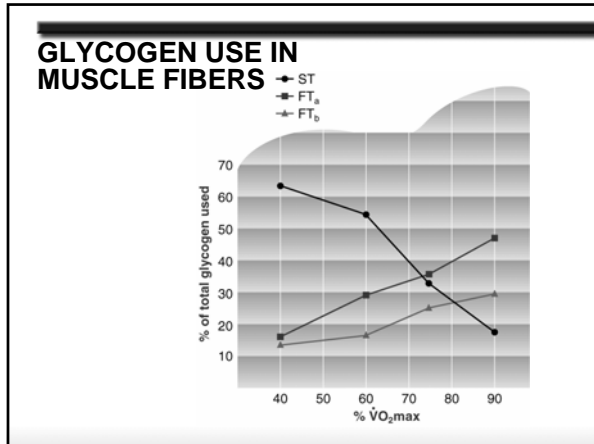
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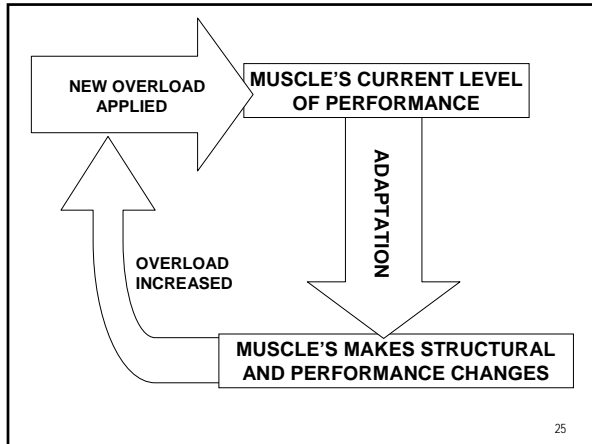
ATP AND PCr DURING SPRINTING



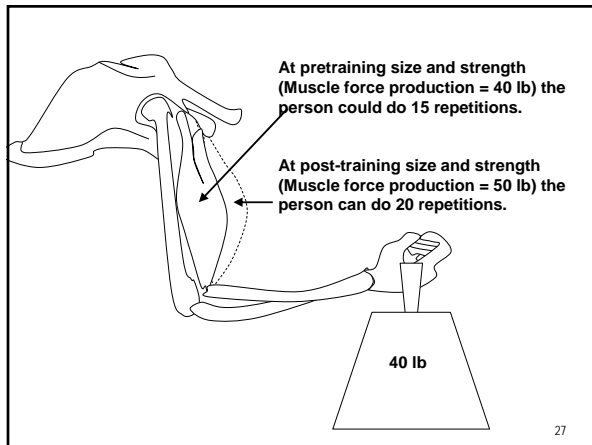
USE OF MUSCLE GLYCOGEN DURING EXERCISE



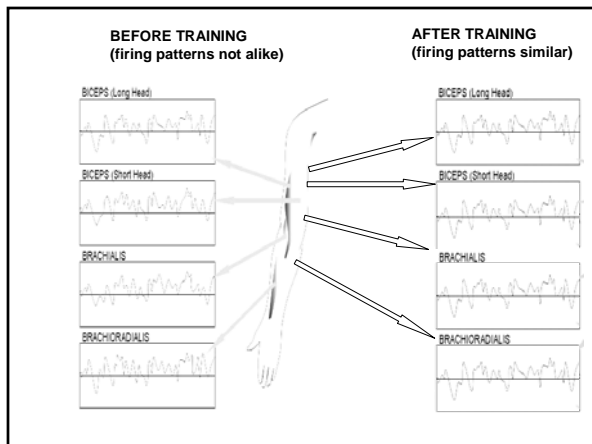




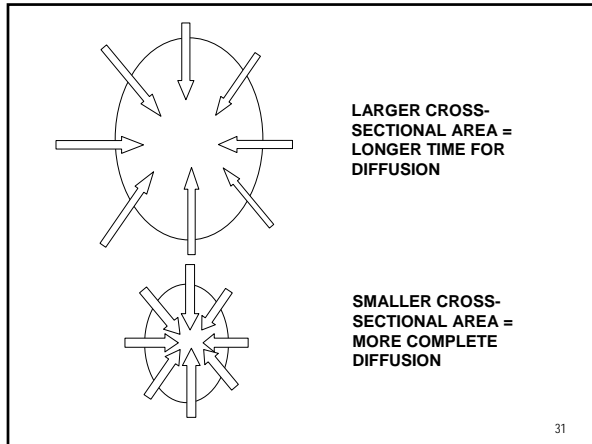
- ### ADAPTATIONS TO STRENGTH TRAINING
- INCREASED STRENGTH, POWER AND ENDURANCE
 - INCREASED FIBER CROSS-SECTIONAL AREA
 - INCREASED TYPE IIA FIBER CONTENT
 - INCREASED LIGAMENT AND TENDON STRENGTH
 - INCREASED BONE DENSITY
 - INCREASED LEAN BODY MASS
 - INCREASED GH, TESTOSTERONE, CORTISOL
 - INCREASED ANAEROBIC ENZYME ACTIVITY
 - INCREASED CP AND GLYCOGEN STORES
 - INCREASE CONTRACTILE SPEED
 - INCREASED "ANAEROBIC" POWER
 - INCREASED MUSCLE SYNCHRONIZATION
 - INCREASED RECRUITMENT CAPACITY
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- ### ADAPTATIONS TO SPEED TRAINING
- INCREASED CONTRACTILE SPEED, POWER AND ENDURANCE
 - INCREASED ANAEROBIC ENZYME ACTIVITY
 - INCREASED CP AND GLYCOGEN STORES
 - INCREASED "ANAEROBIC" POWER
 - INCREASED MUSCLE SYNCHRONIZATION
 - INCREASED RECRUITMENT CAPACITY
 - INCREASED TYPE IIA FIBER CONTENT
 - INCREASED GH, TESTOSTERONE, CORTISOL
 - INCREASED LIGAMENT AND TENDON STRENGTH
 - INCREASED FIBER CROSS-SECTIONAL AREA
 - INCREASED BONE DENSITY
 - INCREASED LEAN BODY MASS
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- ### CHANGES IN SKELETAL MUSCLE WITH ENDURANCE TRAINING
- INCREASED MYOGLOBIN
 - INCREASED NUMBER AND COMPLEXITY OF MITOCHONDRIA
 - INCREASED KREBS ENZYMES AND ETC CARRIERS
 - INCREASED STORES OF GLYCOGEN
 - INCREASED OXIDATIVE USE OF GLYCOGEN
 - INCREASED STORES OF TRIGLYCERIDES
 - INCREASED OXIDATION OF FATS
 - INCREASED CAPILLARY DENSITY
 - MODERATE HYPERTROPHY LIMITED BY DIFFUSION OF O₂
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Training Load

	Endurance	Hypertrophy	Strength	Power	Peaking
Sets	1-3	2-4	2-5	3-5	1-3
Reps	12-20	8-12	4-8	3-5	1-3
Volume	Med	High	High	High	Low
Intensity	Low	Low	Med High	Med-Low	Very High
Rest	30s-60s	60s-90s	2:30-5 min	3-5 min	5-8min
# of Sets	12-15	18-24	16-20	18-21	3-5
Set Duration	60-90s+	45s-75s	15s-30s	1s-15s	3s-5s

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Plyo Programming

	Mon	Tues	Wed	Thurs	Fri	Sat
Lower Body Plyos	✓		✓			
Upper Body Plyos		✓		✓		
Upper Body Weights	✓		✓		✓	
Lower Body Weights		✓		✓		✓
Plyos	✓		✓			
Combo Weights		✓		✓		✓
Plyos	✓			✓		
Combo Weights		✓			✓	

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Agility Programming

	Monday	Tuesday	Wednesday	Thursday	Friday
Upper Body Weights	✓		✓		✓
Lower Body Weights		✓		✓	
Conditioning		✓		✓	
Agility					
Speed-Power	✓		✓		
Agility					
Up / Low Weights	✓		✓		✓
Agilities		✓		✓	
Weights	✓			✓	
Agilities		✓			✓

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