

1 Bioenergetics

Understand Energy Systems

- Start with anaerobic glycolysis
 - Pyruvate to lactate and reduced form - added 2 H⁺
 - Leading to blockage of muscular contraction
 - Increasing Fatigue
- Fitness Fatigue - Decreasing Rate/Amount of Fatigue
 - Fitness adaptation is contingent upon relative level of fatigue
 - Reduce fatigue by increasing other attributes of fitness
- Vertical Integration - Increasing Recoverability
 - Aerobic glycolysis is a vertical integration of anaerobic glycolysis because it limits accumulation of H⁺ and decreasing of pH
 - Increase Recovery from Anaerobic Exercise

Overview

ESD - Optimize Volume/Intensity Intra/Inter Session

- What is needed?

Manage workloads to delay critical drop off

- How do we manage?

HRV/HRR/Relative Intensity during session

- How do we govern?

Energy System Overview

- Understand fatigue as a limiting factor
- Use that to understand appropriate upper limit density wise
- Increase recovery by organizing training by training session, microcycle, mesocycle and mesocycle
- Optimal volume does exist we just do not know if it is enough
 - Critical Drop Off Determines how much
 - Delay that as long as possible by developing pathways that expedite recovery

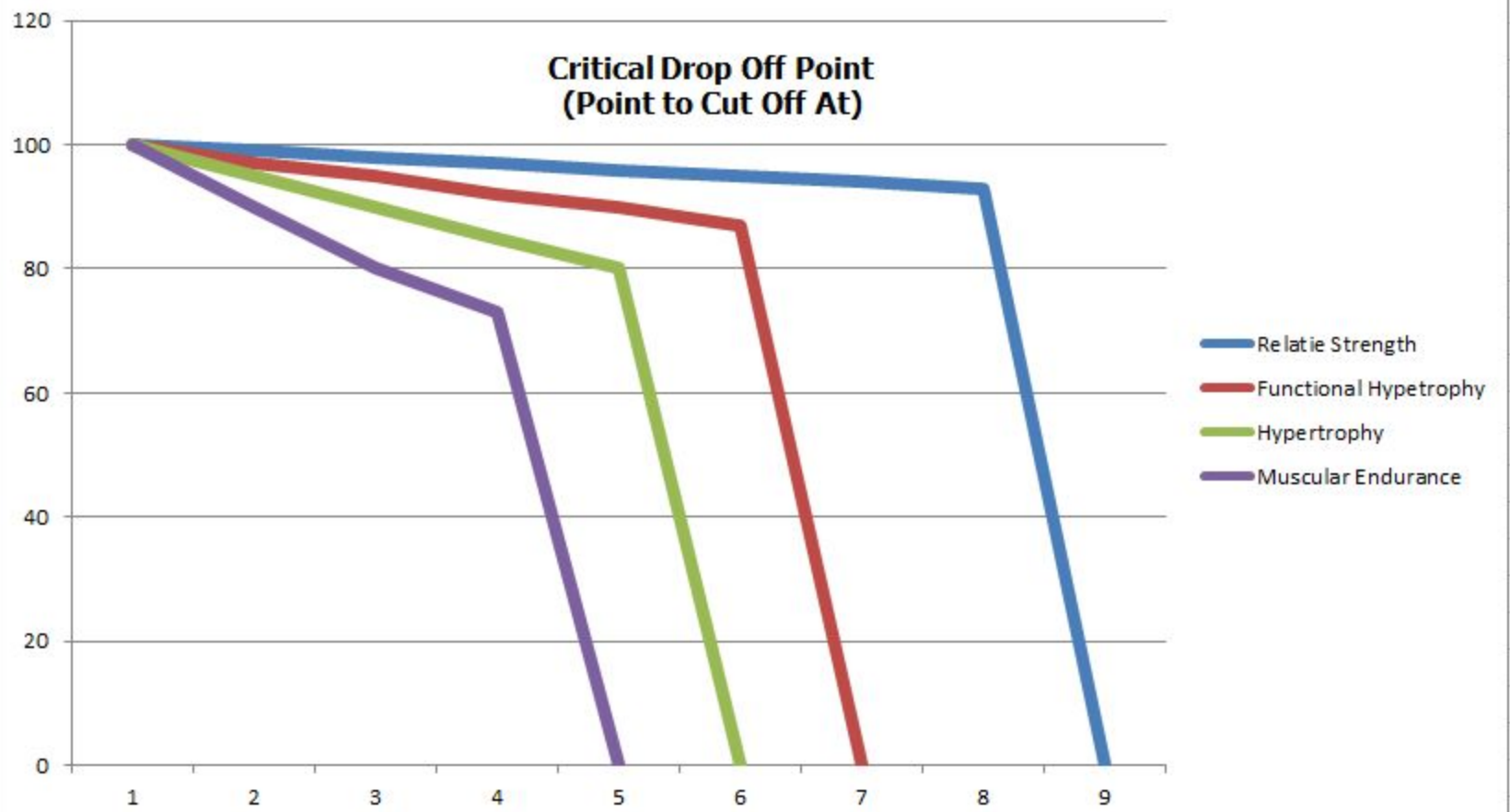
Optimize Volume Through **Delaying** Critical Drop Off

Critical Drop Off

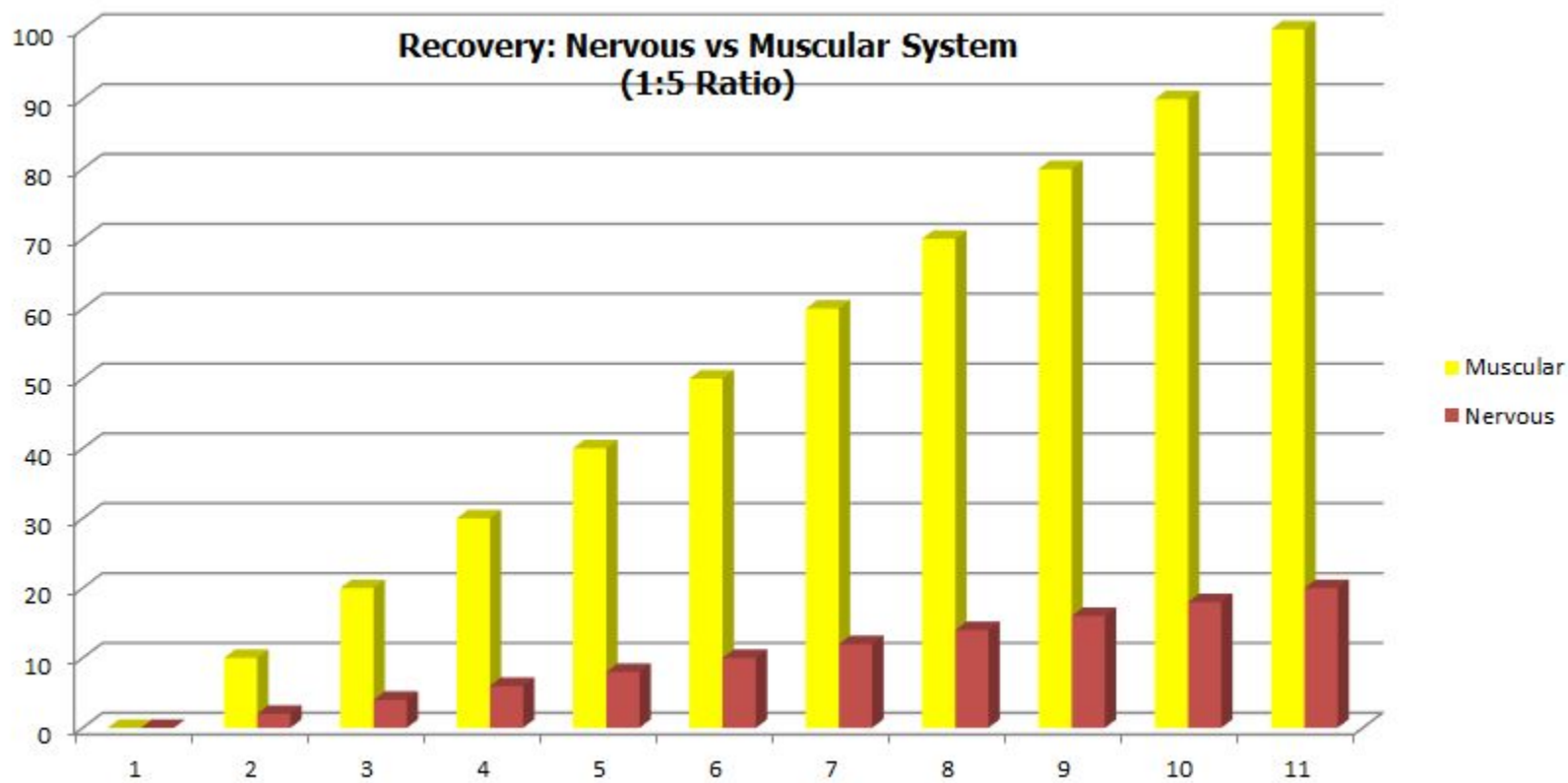
There should be no more than 10% intensity range for given rep bracket

- **Relative Strength (TUT 1-20s): 7% Drop**
 - Rep Range (1 Rep): 2-3, 3-4, 4-5, 5-6
- **Functional Hypertrophy (TUT 20-40s): 13% Drop**
 - Rep Range (2 Reps): 4-6, 6-8, 8-10 Reps
- **Hypertrophy (TUT 40-70s): 18% Drop**
 - Rep Range (4 Reps): 6-10, 8-12, 10-14 Reps
- **Strength Endurance (TUT >70s): 20% Drop**
 - Rep Range (5 Reps): 10-15, 15-20, 20-25 Reps

Critical Drop Off Point (Point to Cut Off At)



**Recovery: Nervous vs Muscular System
(1:5 Ratio)**

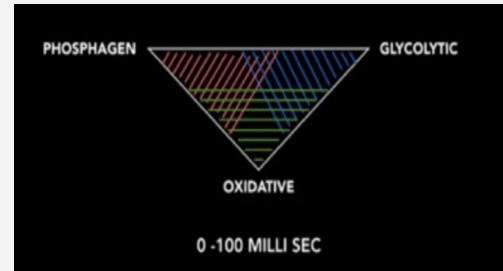
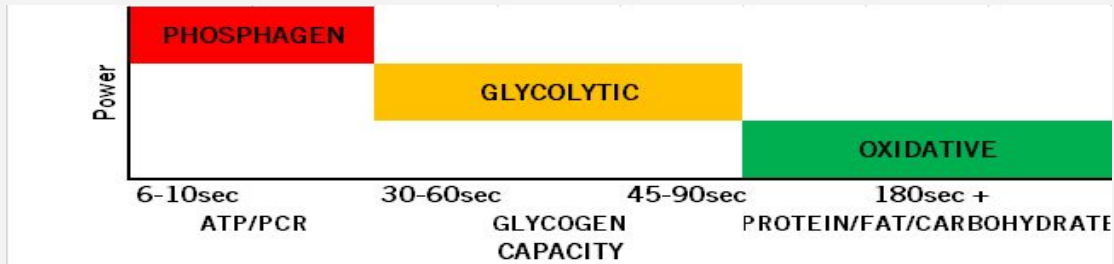


Power vs Capacity

Power is 100% without Regard for Repeatability

Capacity is the Highest % with Regard for Repeatability

- The primary difference with replenishing energy substrates:
 - Phosphagen - ATP/PCR
 - Glycolytic - Glucose/Glycogen (Constant)
 - Oxidative - Glycogen/Fatty Acids/Amino Acids (Constant)



Testing

- VO2 Max
 - $15.3 \times (\text{Max HR} / \text{Resting HR})$
- Max HR
 - $220 - \text{Age}$ (*Most common formula*)
 - $207 - 0.7 \times \text{Age}$ (*Adjusted for people over the age of 40*)
 - $211 - 0.64 \times \text{Age}$ (*Adjusted for generally active people*)
- Anaerobic Threshold
 - 85-90% Max HR
- Blood Glucose
 - Pre Fasting <90mg/dL
 - Intra 130-200mg/dL
 - 1hr Post <130mg/dL

Cardiac Output

- $CO = \text{Stroke Volume} * \text{Heart Rate}$
 - $SV = \text{End Diastolic Volume} - \text{End Systolic Volume}$
- $\dot{V}O_2$ Max Improvement
 - Novice - 50% improvements are attributed to increased stroke volume
 - Advanced - 30% of improvements are attributed to increased stroke volume
 - 8-10% are attributed to increases in maximal oxygen extraction
 - - 60% are attributed to improved movement economy and increased pulmonary diffusion

TARGET ZONE	INTENSITY % OF HR _{max}	EXAMPLE INTERVAL DURATIONS	PHYSIOLOGICAL BENEFIT/ TRAINING EFFECT
5 MAXIMUM	90-100%	0-2 minutes	<ul style="list-style-type: none"> >Tones the neuromuscular system >Increases maximum sprint race speed
4 HARD	80-90%	2-10 minutes	<ul style="list-style-type: none"> >Increases anaerobic tolerance >Improves high speed endurance
3 MODERATE	70-80%	10-40 minutes	<ul style="list-style-type: none"> >Enhances aerobic power >Improves blood circulation
2 LIGHT	60-70%	40-80 minutes	<ul style="list-style-type: none"> >Increases aerobic endurance >Strengthens body to tolerate higher intensity training >Increases fat metabolism
1 VERY LIGHT	50-60%	20-40 minutes	<ul style="list-style-type: none"> >Helps and speeds up recovery after heavier exercises

Managing Capacity

- RHR - ANS Balance - Stroke Volume
 - > 65bpm/min Poor
 - < 50bpm/min Excellent
- Blood Pressure - Pressure in Vascular System - Vagal Tone
 - Diastolic BP - > 80 Poor
 - Diastolic BP - < 70 Excellent
- HRV - System Variability
 - < 40ms Poor
 - > 75ms Excellent
- HRR - CNS Fatigue
 - Parasympathetic Input Between Sympathetic Input
 - < 25bpm/min Poor
 - > 50bpm/min Excellent

Training Session Arrangement

- Movement Prep: **Zone 1-2 (50-70%)**
 - Increase potential/Reduce Risk
 - Raise Body Temperature - More O2 Delivery
 - Ramp Up Contraction: Force/Velocity
 - Increase ROM/Improve Movement Function
- Training Session: **Zone 4-5 (80-100%)**
 - Block - Singular Stimulus
 - Manage work to rest (Density Inversely Proportional to Fatigue)
 - Antagonist Pairings
 - Mixed - Varied Stimulus
 - Organize based on rate of fatigue - High CNS to Low CNS
 - Maintain Structural Balance
- Post Work: **Zone 1-2 (50-70%)**
 - Remove fatigue substrates
 - CNS Reset - Need PNS after SNS

Microcycle Session Arrangement

- Duration
 - Low: 150-180min of Zone 2-3
 - High: 10-30min in Zone 4-5
- Length
 - 5D - Lower, Upper, Rest, Total, Rest
 - 7D - Lower, Upper, Rest, Lower, Upper, Rest, Rest
 - 7D - Total, Rest, Total, Rest, Total, Rest, Rest
- High-Low
 - 5D - High, Low, Rest, High, Rest
 - 7D - High, Low, Rest, High, Low, Rest, Rest
 - 7D - High, Low, High, Low, High, Rest, Rest
- Fiber Type
 - Fast Twitch - More fatigue from High Days - Less High Days
 - Slow Twitch - Less Fatigue from High Days - More High Days

Mesocycle Session Arrangement

- Length
 - 2 Microcycles - M1 90%, M2 100%
 - 3 Microcycles - M1 80%, M2 90%, M3 100%
 - 4 Microcycles - M1 70%, M2 80%, M3 90%, M4 100%
 - 4 Microcycles - M1 80%, M2 80%, M3 70%, M4 100%
- Rates of Change
 - Mesocycle to Mesocycle change of intensity: 8-15%
- Muscle Fiber Type
 - Fast Twitch - Shorter Mesos, Larger Rates of Change
 - Eccentric Stress > Isometric/Concentric Stress - Shorter Mesocycles
 - Slow Twitch - Longer Mesos, Smaller Rates of Change
 - Isometric/Concentric Stress < Eccentric - Longer Mesocycles

Macrocycle Session Arrangement

- Long to Short
 - Inhalation Bias
 - Fast Twitch
 - Poor Oxidative Function
- Short to Long
 - Exhalation Bias
 - Slow Twitch
 - Poor Anaerobic Phosphagen Function
- Highest Tonnage/High Intensity Yardage
 - Maximal Intensity
 - Rest - Amount of Fatigue, Rate of Recovery

Take Home

- Get as close as possible to critical drop off - maximal intensity
- Manage volume by maintaining intensity
- Organize training by how much someone may fatigue and how quickly they can recover
- Frameworks are based timeline and need
 - Eliminate noise if you are uncertain

Resources

[8 Weeks Out](#)

[Key Concepts](#)

[Evan Peikon](#)