



## Dave Scott's RACE AGAINST AGE: Training the Masters+ Athlete for Peak Performance

Dave Scott

[info@davescottinc.com](mailto:info@davescottinc.com)

[davescottinc.com](http://davescottinc.com)

David Glover, MS, CSCS

[david@enduranceworks.net](mailto:david@enduranceworks.net)

[enduranceworks.net](http://enduranceworks.net)

# Dave (age 58) at Luray Triathlon in 2012

---



Does getting older make us slower....? Yes, of course, but....

---

*“Life is like a ten speed bicycle.  
Most of us have gears we never  
use.”*

— Charles M. Schultz



# Goals for presentation

---

- Educate on aging and impacts to performance
- Identify exercise strategies to offset aging effects and improve performance
- Provide training guidelines for implementing strategies
- Provide specific strength workout routines

# Being endurance athletes increases life expectancy... however, endurance training is not enough...

---

*“Aerobic endurance sports resulted on average in a 4.3 to 8.0 years higher life expectancy...compared to that for normal physical activity.”*

# As we age, changes in muscle strength and power (and performance) are impacted by a number of factors

---

- Reductions in muscle mass
- Nervous system changes
- Hormonal changes
- Poor nutrition
- Physical inactivity

# Let's look at an example athlete - Marty

- Past training:
  - 3-4x bike and run per week
  - Mostly aerobic pace on bike on run
  - Climbed hills on bike but slow, comfortable
  - No strength training
- Issues:
  - Poor posture and core stability (especially on run)
  - Terrible balance
  - Bone on bone in knees
  - Upcoming shoulder surgery (tear)



# What did Dave recommend for Marty and what were the results?

- Progressive strength program 3x/week to work on:
  - Glutes/hips,
  - Lower abs and
  - Transverse abdominis
- Introduce interval sets into hill climbing workouts
- Focus on proper posture





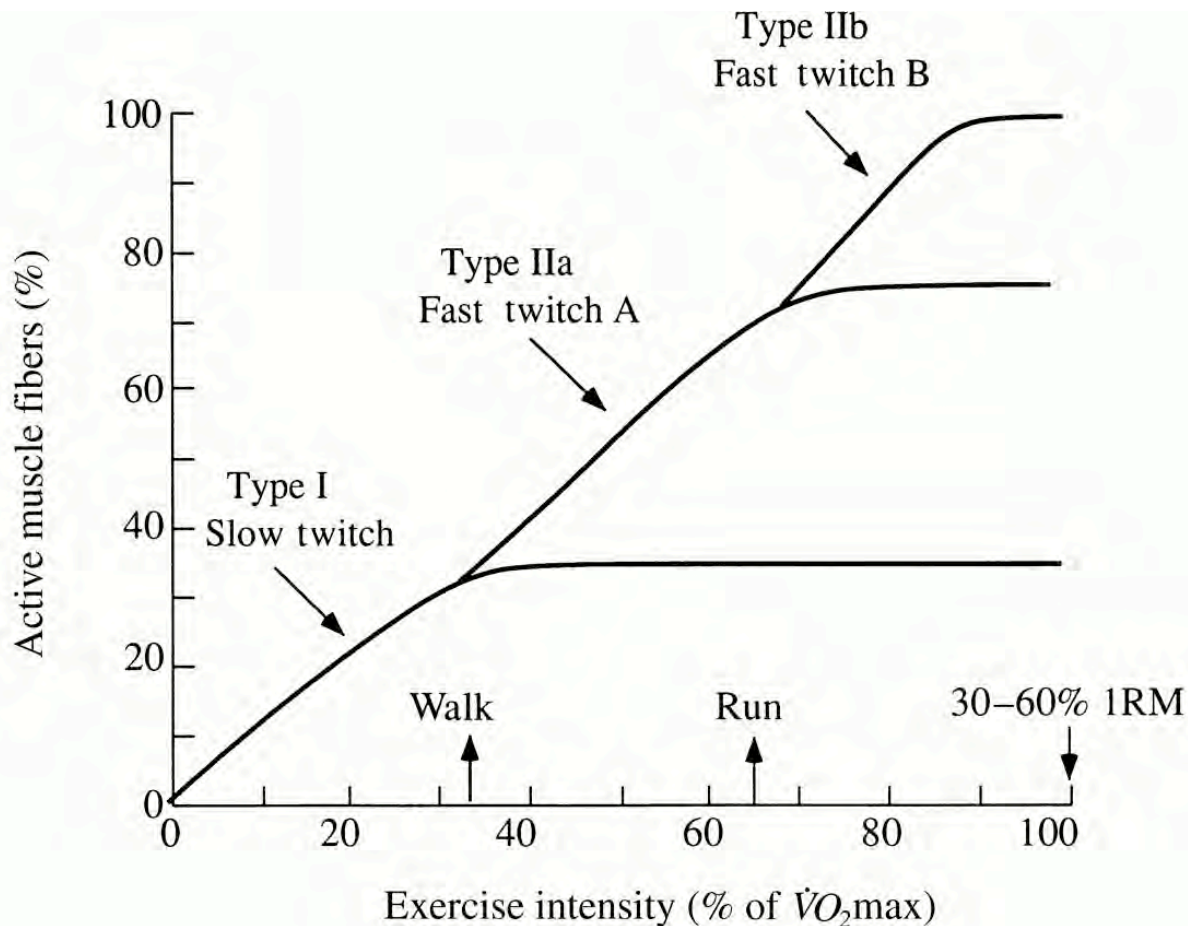
# A brief overview of muscle fibers as they're the source of all movement by the human body

Characteristics	"Slow Twitch"		"Fast Twitch"	
	Type I	Type IIa Fast Oxidative Glycolytic	Type IIb / IIx Fast Glycolytic	
Contraction speed	Slow	Fast	Fast / Explosive	
Fiber Color	Red	White/Red	White	
Fiber diameter	Small	Intermediate	Large	
Fatigue resistance	High	Intermediate / Low	Low	
Force production	Low	Intermediate	High	
Capillary density	High	Intermediate	Low	
Predominant Energy System	Aerobic	Combination	Anaerobic	



Takeaway: Trained Type IIa fibers allow top end endurance performance

# Muscle fibers are recruited incrementally under the “all-or-none” principle



## Fast Twitch vs. Slow Twitch

- 5x contractile force
- 5x fatigue rate

**Takeaway: Exercise at higher intensities to train and maintain fast twitch fibers**

Chart: Coyle E F, "Physical activity as a metabolic stressor." Am J Clin Nutr 2000;72:512S-520S

# “Typical” endurance training can lead to other problems as we age

---

## “Typical” endurance training

- Long, slow training
- Highly repetitive motions in single plane of motion
- No strength training

## Common problems:

- Muscle weaknesses
- Muscle strength imbalances
- Prone to overuse injuries
- Muscle asymmetry – dominant sides
- Loss of proprioception
- Loss of range of motion
- Poor joint and core stability
- Poor balance

# The bottom line – train all muscle fiber types

---

- A “mixed” training load each week will create the greatest gains in training
- Interval and strength training innervates all muscle fiber types
- Threshold training, VO<sub>2</sub> and aerobic training combined with strength training create the greatest gains in performance to offset aging declines

# Use it or lose it as you age

---

- Evidence from past cross-sectional studies indicated greater loss of atrophy and loss of Type II muscle fibers with aging
- More recent studies suggest greater atrophy of Type II may be more related to disuse rather than aging ***since it can be reversed by strength training.***
- Proportion of Type I & II fibers seems maintained in lifelong trained athletes

4 Takeaway: Incorporate high intensity all year as part of training program (vary duration and segment as appropriate to time of season)

Source: Rittweger, et al. "Sprint and endurance power and ageing: an analysis of master athletic world records." *Proc. R. Soc.* 2008, 688.

# Terms defined for aging-related issues

---

- Sarcopenia - reduced muscle size and strength as a result of aging or inactivity
  - Losses in both number and size of muscle fibers
  - Gradual and selective denervation of muscle fibers
  - Has a negative influence on the ability to perform tasks of daily living
- Loss of bone mineral density (weaker bones)
  - Osteopenia – bone mineral density between -1 and -2.5 standard deviations (SD) of young adult mean
  - Osteoporosis (worse) – bone mineral density below -2.5 SD of young adult mean
  - Greater potential for bone breakage

# So what happens to our muscles and skeleton as we age? (summarized)

Characteristic	Aging
Muscular strength	↓
Power	↓
Muscular endurance	↓
Muscle mass	↓
Muscle fiber size	↓
Muscular metabolic capacity	↓
Resting metabolic rate	↓
Body fat	↑
Bone mineral density	↓
Physical function	↓
Anabolic hormones	↓

Source: *Essentials of Strength and Conditioning*, NSCA, 155

# The good news is that strength training can offset all of these musculoskeletal changes

Characteristic	Aging	Resistance Training
Muscular strength	↓	↑
Power	↓	↑
Muscular endurance	↓	↑
Muscle mass	↓	↑
Muscle fiber size	↓	↑
Muscular metabolic capacity	↓	↑
Resting metabolic rate	↓	↑
Body fat	↑	↓
Bone mineral density	↓	↑
Physical function	↓	↑
Anabolic hormones	↓	↑

Both aerobic & strength exercise are beneficial for older adults but only strength training increases muscular strength, muscle mass & bone density

Source: *Essentials of Strength and Conditioning*, NSCA, 155



# Guidelines for strength training

---

- Perform exercises that:
  - Stimulate Fast Twitch (Type IIa, IIb) muscle fibers
  - Incorporate stability, balance, strength and power
  - Load spine
  - Enhance major muscle movers
  - Engage stabilizers (front and back – 29 muscles)
- Perform exercises with controlled, fast movement (not ballistic)
  - 8 to 20 repetitions (depending on exercise) to muscular fatigue – can do 2 or 3 more reps with good form
  - 2-3 sets per exercise
- Choosing exercises:
  - Progress from where athlete is today
  - Full kinetic chain exercises (address sarcopenia, osteopenia, core stability, anabolic hormone enhancement)
  - Small groups of multi-plane exercises back to back to maximize muscle fiber recruitment

# Example of predominantly glute exercise sequencing

	Exercise	Description
1A	Lateral dog lifts	On hands and knees, arms & legs shoulder-width and hip-width apart. Arms straight. Head in neutral position. Pelvis tucked anteriorly with hips square to the floor (i.e., minimal rotation). Keep foot outside of knee line at full contraction. Externally rotate left/right knee out. Maintain greater than 90° flexion at the knee at full contraction. Return knee to floor (do not touch floor). Repeat pattern.
1B	Lateral leg swings	On hands and knees, arms & legs shoulder-width and hip-width apart. Arms straight. Head in neutral position. Pelvis tucked anteriorly with hips square to the floor (i.e. minimal rotation). In a big arc, swing leg forward to 90°. Touch in-step to floor. Using same arc, swing leg back to 30°. Touch in-step to floor. Repeat pattern.
1C	Lateral leg up and downs	Supported on hands and knees, arms & legs shoulder-width and hip-width apart. Arms straight. Head in neutral position. Pelvis tucked anteriorly with hips square to the floor (i.e. minimal rotation). With leg straight, touch instep to floor at 30°, 60° & 90° without rest. Repeat pattern.
1D	Mule kicks	On hands and knees, arms & legs shoulder-width and hip-width apart. Arms straight. Head in neutral position. Pelvis tucked anteriorly with hips square to the floor, careful not to arch back. With three distinct movements: 1. pull knee into chest, kick straight back and slightly upward with heel leading, hold contraction. Flex knee, kick upward with heel leading. Externally rotate knee. Reverse pattern. Repeat pattern.
1E	Leg Circles	On hands and knees, arms & legs shoulder-width and hip-width apart. Arms straight. Head in neutral position. Pelvis tucked anteriorly with hips square to the floor (i.e. minimal rotation). With leg straight, make large circular pattern (clockwise) so that muscles are at maximum contraction throughout circular motion. Repeat pattern in counter clockwise pattern.

# Example of predominantly glute exercise sequencing (cont'd)

	Exercise	Description
2A	Lying Side Clams	Lie on your side with your back to the wall with your knees bent 45 deg. to the wall, heels touching the wall. Your bottom arm should be extended straight ahead with your ear on your bicep. Stretch your top arm out in front and hold about 6 cm above the floor. Keep your heels together and raise your knee as high as you can and lower.
2B	Lying Wall Crawlers	Lie on your side with your “top” arm extended, holding 6 cm off the ground. Both legs are straight. Lift your top leg up the wall, keeping your heel in contact with the wall. Squeeze our those final 3–4 cm.). Keep your ankle flexed.
3	Stretch Cord Sumo Walk	Stepping into an elastic ribbon, standing with knees bent, shoulder-width apart, feet slightly everted. Place hands on knees or arms swinging freely, or elbows on knees. Squat slightly, knee flexion should be 120°. Alternating legs, lift knee up to hip-height with foot 8” to 15” from floor.
4	Soaring	Stand on one leg with straight leg. Tip arms side to side.
5	Plated squat	Hold the weight next to your chest, crossing your arms to secure the plate. Hinge at your hips and lower to 110-degree knee flexion. Press up to standing position and repeat.
6	Box Jump	Stand in front of an elevated box (12”-24”). Use your arms to jump forward and up on to the box. Jump down.

# Optimize muscle adaptation and strength training by separating strength and endurance training

---

- Ideally, allow 2 hours or more between sessions for strength and endurance training
- Strength promotes physiological pathways for “fast” muscle contractions
- Endurance promotes pathways for “slow” muscle contractions
- Pathways interfere when back to back

Take away: Do strength training first (↑ human growth hormone (HGH) & testosterone) plus higher load for Type II muscle fiber development

# Increase fat burning by stimulating nervous system

---

- HSL (Hormone Sensitive Lipase – enzyme) releases fat from fat cells IF nervous system is stimulated
- Nervous system needs “shock” stimulus – higher intensity training
- Long slow distance does not rev-up FFA usage

Take away: “Shock” nervous system with swing sets, shorter intervals incorporated into long, slow distance workouts

# Differences between strength training programs for men and women

---

- Only real difference between training programs is the amount of resistance used for a given exercise.
  - Muscle groups involved in a particular sport are the same
  - Misperception that women lose flexibility or develop “bulky” muscles if weight train
- Two areas of consideration:
  - Development of upper body strength (tends to be less than that of men)
  - Prevention of sport-related injuries, especially those involving the knee (Q Angle)

Source: *Essentials of Strength and Conditioning*, NSCA, 152-3

Intervals and strength training should be incorporated year round (as appropriate to the training period)

---

Training Period:	Base Building	Transition	In Season	Off Season
Purpose:	Improve aerobic "plumbing"	Transition to race-specific efforts	Develop race-specific adaptations & prepare for demands of racing; injury prevention.	Post-season recovery & transition to base building; identify and target weaknesses.

**Takeaway: Incorporate weekly strength and interval training regardless of distance and time of year!**

# Thank you for your time today!

---

- USAT will provide copy of presentation & sample strength programs.
- See: *Dave Scott's Go Faster: The Practical Application Of Exercise Physiology To Maximize Your Triathlon Success* in USAT Webinar archives (3/20/2012).
- Please contact us with any questions / feedback regarding this webinar or for additional resources.



Dave Scott  
[info@davescottinc.com](mailto:info@davescottinc.com)  
[www.davescottinc.com](http://www.davescottinc.com)



David Glover, MS, CSCS  
[david@enduranceworks.net](mailto:david@enduranceworks.net)  
[www.enduranceworks.net](http://www.enduranceworks.net)



# Appendix

---

# Special considerations for an individual's training program

---

- Fitness background
- Current fitness level
- Exercise experience (may vary by sport)
- Injury / history of injury
- Goals
- Time availability

# Guidelines for prescribing intervals

Training Zone	Rep Duration	# Repetitions	Rest Between Reps*
Anaerobic Endurance (AE)	30" to 90"	4 to 12	Swim: 1' B & R: 90" to 2'
Aerobic Capacity (VO <sub>2</sub> Max)	3' to 7' (can be split)	2 to 5 (12' to 24' total)	Exercise time = rest time
Lactate Threshold	L3	5' to 30' (can be split)	S: 30" to 60" B & R: 60" to 180"
Sub LT	L2	5' to 1 hr (can be split)	S: 5" to 45" B & R: 15" to 90"
	L1	Same as L2	Same as L2
Aerobic (A)	20' to 5 hrs (continuous)	Continuous reps 20'+	15" to 90"

Key:  
' = minutes  
" = seconds  
hr = hour

**Takeaway: You can progress faster by keeping segment lengths shorter (e.g. 12 x 50m versus 4 x 100m AE sets in pool)**

\* If humidity index is high, you're not going to get cooling effect so will need to extend rest interval

# What a “typical” training week might look like...

Workout	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Swim	OFF	OFF	LT VO2	OFF	AE	Long Sub LT	OFF
Bike	OFF	LT	OFF	A	OFF	Long Sub LT	OFF
Run	OFF	A	LT	OFF	VO2	Off	Long Sub LT

KEY: A = Aerobic, LT = Lactate Threshold, Sub LT = Just under LT, VO2 = Aerobic Capacity, AE = Anaerobic Endurance

Takeaway: Spread out workouts within a week while alternating harder workouts with easier workouts

# The body adapts to training after 5-12 sessions of a new energy system or training workload (observed)

- Minimum time is 2 weeks.
- Preferred time is 3-6 weeks during a training cycle.
- Similar workouts produce a physiological adaptation.

Example swim progression weeks:

Week	M	Tu	W	Th	F	Sa	Su
1		X		X			
2		X		X			
3		X		X ✓			

X = VO2 set

Takeaway: Repeating “like” sessions is one of the physiological adaptations for measuring progress

# Example swim workouts

Workout Type	Workout	Progression #1	Progression #2
Anaerobic Endurance (AE)	4 x 75 maximal effort w/ 1 min recovery	5 x 75 + 2 x 50 maximal effort w/ 1 min recovery	6 x 75 + 3 x 50 maximal effort w/ 1 min recovery
Aerobic Capacity (VO <sub>2</sub> Max)	3 x (25-125-100-50 @ 1:28 pace w/ 10" RI) & 4' easy between sets	3 x (200-50-50 @ 1:28 pace w/ 10" RI) & 4' easy between sets	3 x 300 @ 1:28 pace w/ 4' easy swimming between
Lactate Threshold (L3)	5 x 400 @ 1:30 pace w/ 60" RI	5 x 500 @ 1:30 pace w/ 60" RI	2 x 500 @ 1:30 pace w/ 60" RI followed by 1500m for time
Aerobic (A) with Sub LT (L1, L2)	5 x 400 A build up to L1 w/ 15" RI	4 x 500 A build up to L1 w/ 15" RI	5 x 400 A build up to L2 w/ 15" RI

- Key:
- ' = minutes
- " = seconds
- hrs = hours
- RI = rest interval

# Example bike workouts

Workout Type	Workout	Progression #1	Progression #2
Anaerobic Endurance (AE)	6 x 80" – max effort w/ 90" RI	8 x 80" – max effort w/ 90" RI	10 x 80" – max efforts w/ 90" RI
Aerobic Capacity (VO <sub>2</sub> Max)	Sets (4' RI in between): 1: 4' VO <sub>2</sub> 2: 3', 2' VO <sub>2</sub> w/ 30" RI 3: 2', 2' VO <sub>2</sub> w/ 30" RI	Sets (4' RI in between): 1: 5' VO <sub>2</sub> 2: 3', 2' VO <sub>2</sub> w/ 30" RI 3: 2', 2' VO <sub>2</sub> w/ 30" RI	Sets (4' RI in between): 1: 6' VO <sub>2</sub> 2: 3', 3' VO <sub>2</sub> w/ 30" RI 3: 3', 2' VO <sub>2</sub> w/ 30" RI
Lactate Threshold (L3)	3 x 6 min at LT w/ 60" RI	3 x 8 min at LT w/ 60" RI	30' time trial
Aerobic (A) w/ Sub Lactate Threshold (L1, L2)	2 hrs A w/ 2 x 12' L1 @ 20" RI	2.5 hrs A w/ 2 x (9' L1 + 3' L2) @ 30" RI	3 hrs A w/ 2 x (10' L1 + 5' L2) @ 30" RI

□ Key:  
 ' = minutes  
 " = seconds  
 hrs = hours  
 RI = rest interval

# Example run workouts

Workout Type	Workout	Progression #1	Progression #2
Anaerobic Endurance (AE)	6 x 1' @ AE w/ 1' RI	8 x 1' @ AE w/ 1' RI	10 x 1' @ AE w/ 1' RI
Aerobic Capacity (VO <sub>2</sub> Max)	4 x 3' VO <sub>2</sub> w/ 3' RI	4 x 3.5' VO <sub>2</sub> w/ 3' RI	4 x 4' min VO <sub>2</sub> w/ 4' RI
Lactate Threshold (LT3)	3 x 6' @ LT3 w/ 90" RI	4 x 6' @ LT3 w/ 90" RI	3 x 8' @ LT3 w/ 90" RI
Aerobic (A) with Sub Lactate Threshold (LT1, LT2)	Repeat 6' A / 3' LT1 for 7 miles	Repeat 6' A / 3'30" LT1 for 7 miles	Repeat 6' A / 2'30" LT1 / 1' LT2 for 7 miles

- Key:
- ' = minutes
- " = seconds
- hrs = hours
- RI = rest interval