

# *The Profiling and Preparation of an Elite Junior Miler*



Scott Christensen  
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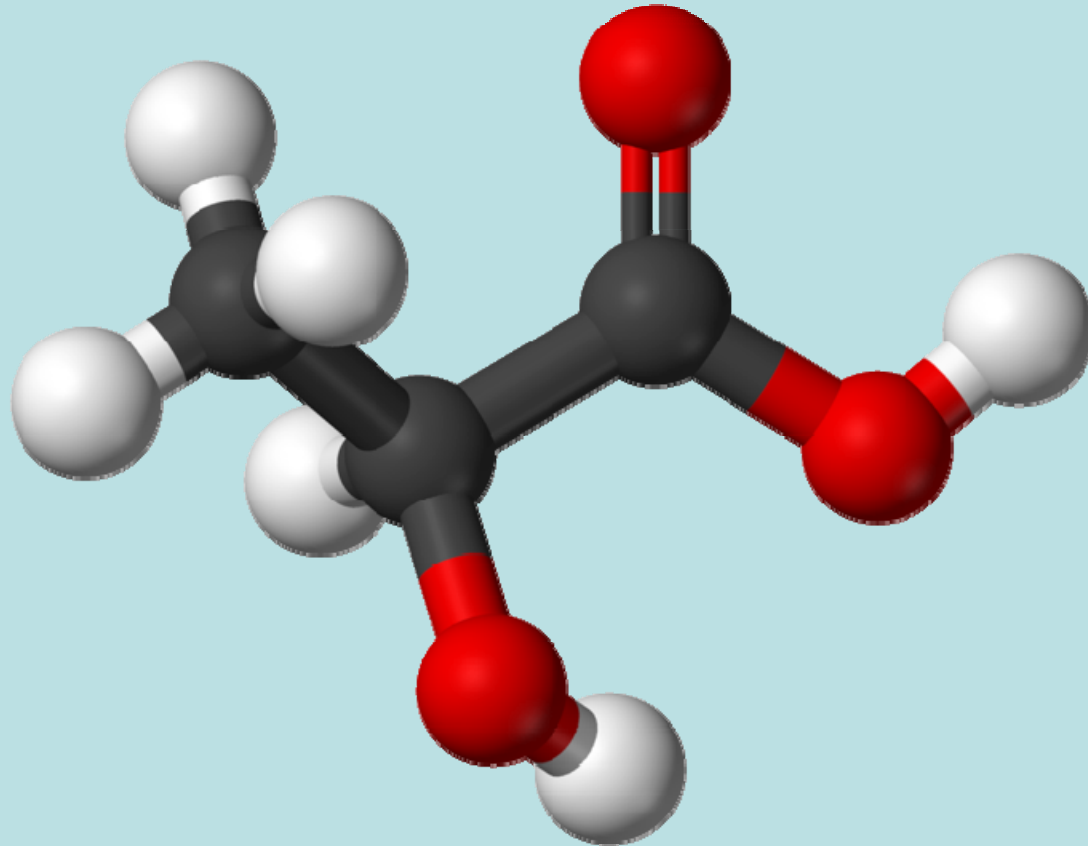
*“The 800 and 1500 meter events are physiologically very close, but very distant psychologically” Peter Coe.*



Successful racing in the fast end of  
the combined zone (800 and 1500)  
relies on managing oxygen  
and.....



# The toleration of disassociated Lactic Acid ( $\text{C}_3\text{H}_5\text{O}_3^- + \text{H}^+$ )



# Anaerobic and Aerobic Energy Contributions

<u>Event</u>	<u>Aerobic</u>	<u>Anaerobic Glycolytic</u>	<u>Anaerobic Alactic</u>
• 800 meters	40%	55%	5%
• 1500 meters	50%	48%	2%
• 3200 meters	70%	30%	<1%
• 5000 meters	80%	20%	<1%

Wilmore and Costill 1985

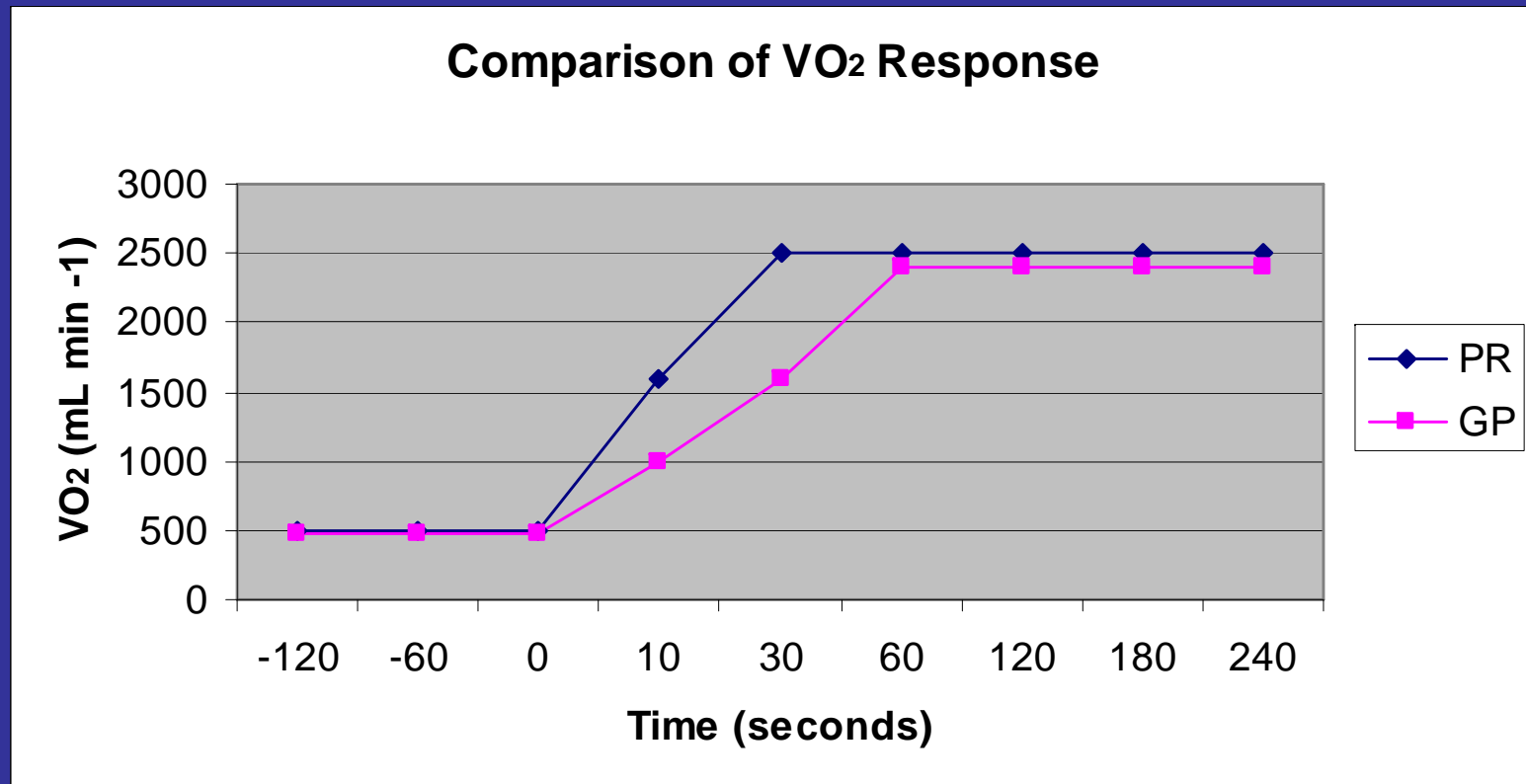
# Physiological Definition of “Elite” in Endurance Events

- A genetic/trained physiological shift in an athlete to a greater contribution by the aerobic energy system at a combined zone race distance.
- **Example: 3000 meter race.**
  - *General Population* = 70% aerobic/30% anaerobic
  - *Paula Ratcliffe* = 85% aerobic/15% anaerobic

# *VO<sub>2</sub> Kinetics to Steady State*

## *@ 16 km/hour*

### *Jones and Berger 2008*



## *It Is All About Preparation*

“ If given 8 hours to cut down an oak tree, I would spend the first 6 hours sharpening my axe.”

*Abraham Lincoln*



# *Preparation Considerations for the Training Periods of the Elite Miler*

- Determining goals, objectives, and physiological parameters.
- $v\text{VO}_2$  max pace [date]
- vAT pace [date]
- vLT pace [date]
- Psychological needs of the athlete are prioritized.



# Goals and Objectives

	800 Meters	1600 Meters	vVO <sub>2</sub>	5000 Meters
December	2:05.30	4:27.00	4:56.00	15:37.00
January	2:04.05	4:25.00	4:53.00	15:31.00
February	2:02.81	4:23.00	4:51.00	15:24.00
March	2:01.58	4:21.00	4:48.50	15:11.50
April	1:57.34	4:14.00	4:42.30	14:51.35
May	1:54.87	4:09.78	4:34.50	14:37.50
State Meet	1:53.52	4:06.23	4:31.80	14:26.32
Junior Nats	1:51.78	4:04.36	4:28.30	14:23.30

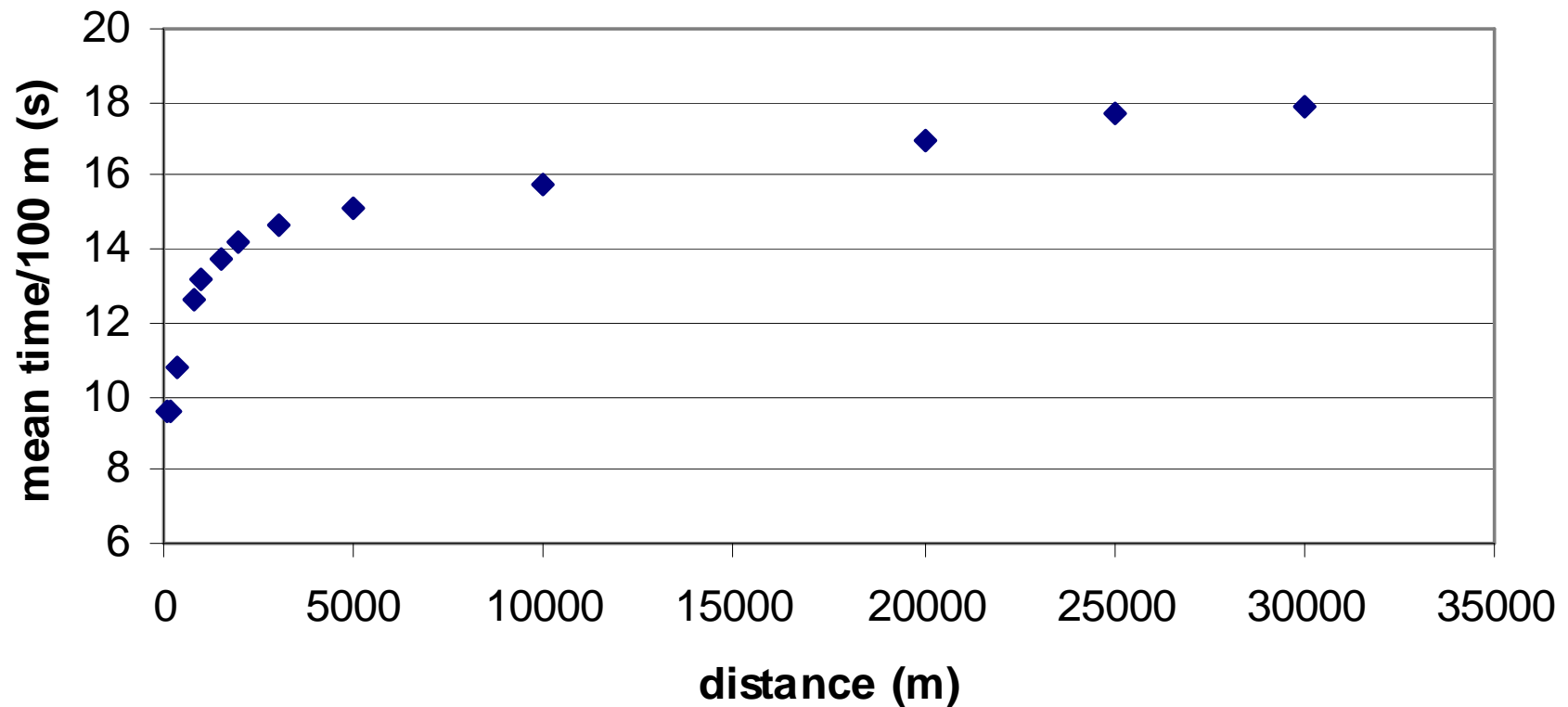
# Physiological Parameters

	200-400	400-600	600-800	1000-1600	20-40 Min.
	120% VO <sub>2</sub>	114% VO <sub>2</sub>	105% VO <sub>2</sub>	100% VO <sub>2</sub>	LT 85% VO <sub>2</sub>
Dec	62.65	67.69	4:51.00	4:56.95	5:44.00
Jan	62.02	66.78	4:49.00	4:53.98	5:42.20
Feb	61.41	65.66	4:47.00	4:51.04	5:40.23
March	60.79	64.83	4:43.50	4:48.13	5:36.30
April	58.36	63.00	4:37.30	4:42.63	5:28.30
May	57.85	62.02	4:30.50	4:34.30	5:23.89
State	57.21	61.20	4:28.80	4:31.20	5:18.32
Junior Nat	55.93	61.08	4:25.30	4:28.33	5:15.10

# Training Sprinters vs. Distance Runners

## [Rate vs. Economy]

WR Mean Time per 100 m vs. Distance



*Designing the elements of the 1500  
macrocycle so that the best  
performances are at the end of the  
season » should be the number one  
objective.*



## *Specific Periods Within the 1500 Meter Macrocycle*

- The **Preparation Period** focuses on the athlete as an endurance runner.
- The **Competition Period** focuses on the athlete as a miler.
- The **Transition Period** allows the athlete to prepare for the next stage of development.

# *Training Modalities for Middle Distance Runners*

- The Long Run **IMPORTANT**
- Tempo Run **IMPORTANT**
- Strength Run **IMPORTANT**
  
- Recovery/Base Run **CRITICAL**
- $VO_{2\max}$  Run **CRITICAL**
- Interval Run **CRITICAL**
- Repetition Run **CRITICAL**

# The Multi-Paced Training Scheme

- Based on a 12 day microcycle.
- The long run, tempo run, strength run, recovery run, and races are included within the 12 days.
- The 12 day cycle also includes one day each of five distinctively varied paces that predominantly deliver ATP through the anaerobic energy system.



# The 5 Paces of the Multi-Paced Training Scheme for the 800/1500.

- $\text{VO}_2$  max Run (800-3200 meters)
- Special Endurance 2 (500-600 meters)
- Special Endurance 1 (300-500 meters)
- Speed Endurance (150 meters)
- Speed (30-60 meters)

Frank Horwill, Peter Coe, and Sebastian Coe

## *VO<sub>2</sub> max Field Tests*

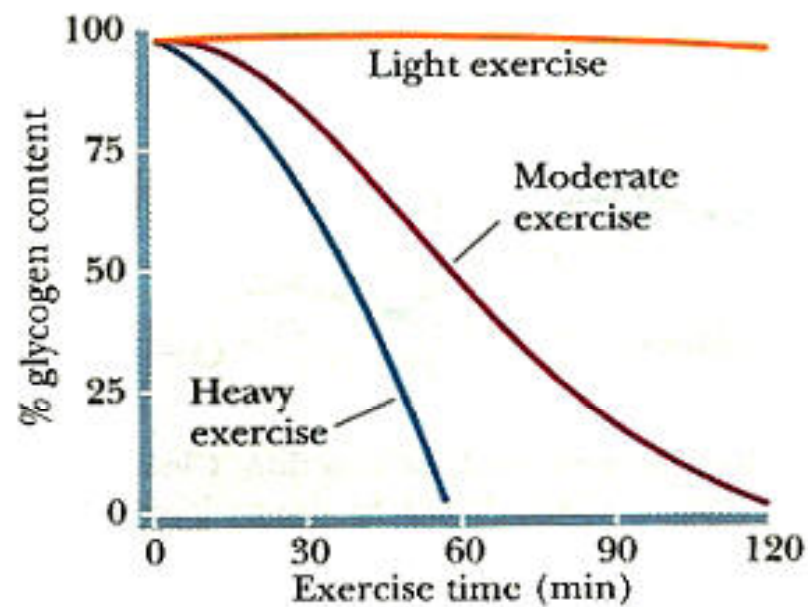
- *Buchfuhr* protocol: 10 min to exhaustion. (d)
- *Astrand* protocol: 2 miles at exhaustive pace. (t)
- *Taylor* protocol: 65% of date pace exhaustive 400 meters. (p)

# Long Run

- Outer reach of fitness level is the goal
- Fatty acid rather than carbohydrate is the primary energy source
- Done at the **aerobic threshold**, 70%  $\dot{V}O_2$  max pace
- Pace consideration when done in a group
- Extent is 20% of weekly mileage throughout the macrocycle

# Fuel Depletions and Limits

## Glycogen Utilization in Working Muscle

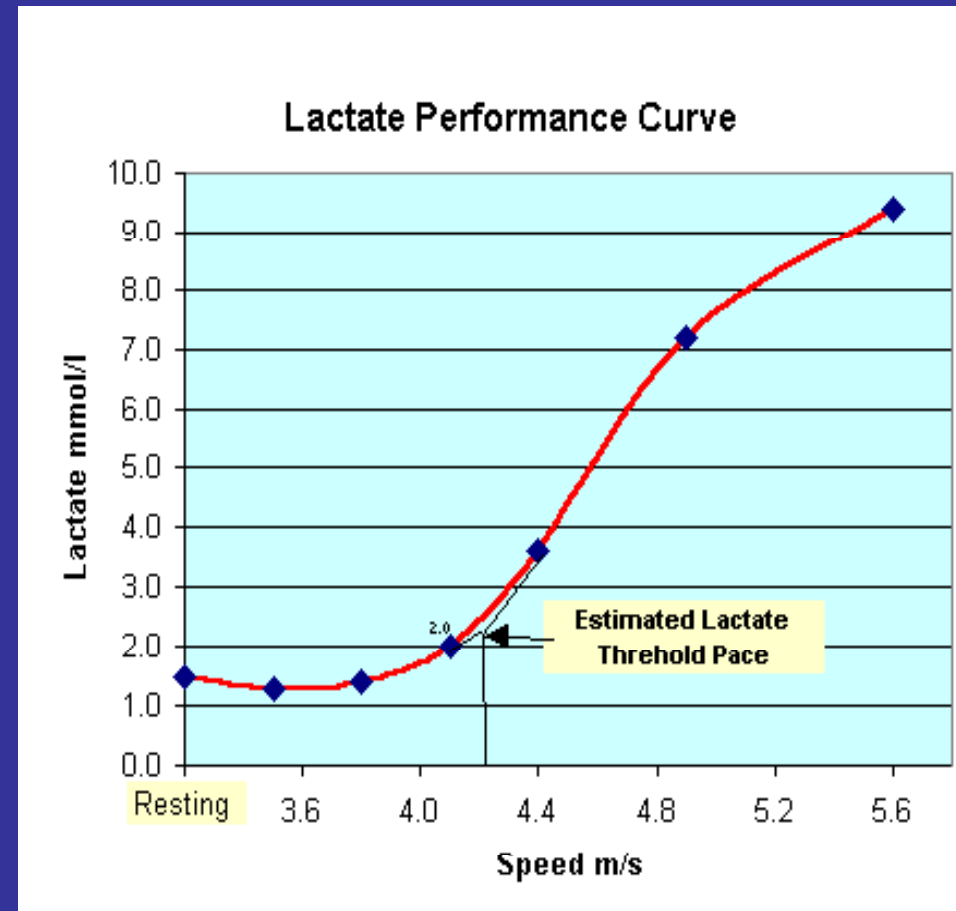


Biochemistry, 3rd ed, Garrett and Grisham, 2004, p. 772



# Anaerobic/Lactate Threshold

- The speed at which  $H^+$  ions begin accumulating.
- Measured by lactate concentrations.
- About 15K pace (4.2 m/s) is the training mark, or 85% of  $VO_{2\text{ max}}$  **velocity**.
- **Tempo runs** are done as a percentage of  $VO_{2\text{ max}}$  **velocity**.



# Strength Run

- Greater applied force against resistance is the goal.
- Any running is strength work.
- Hills are the main target workout.
- Hills are done in 4 microcycle blocks of time.
- 35-45 second bouts of work.
- 4 minute jog of incomplete recovery.
- Sets of 6-8.

# Recovery Run

- Recovery has many aspects and may simply be adding base mileage at the aerobic threshold pace. **Shorter in distance than the long run.**
- Energy system recovery and muscle repair are the biggest concerns.
- **20 min run at minimum.**



# A Critical Understanding of $\text{VO}_2 \text{ max}$ is Necessary for the 800/1500

- Aerobic power improves due to cardiovascular development.
- Cardiac Output (Q) = HR x SV
- $\text{VO}_2 \text{ max} = \text{HR} \times \text{SV} \times \text{A-vO}_2 \text{ diff}$
- $\text{HR}_{\text{max}} = 207 - 0.7 \times \text{age}$
- $\text{VO}_2 \text{ max}$  pace HR is ~88% of  $\text{HR}_{\text{max}}$



# Percentage of $\text{VO}_2 \text{ max}$ as a Function of Race Velocity

<u>Event</u>	<u>% of <math>\text{VO}_2 \text{ max}</math></u>
• <b>800 Meters</b>	<b>120-125%</b>
• <b>1500-1600 Meters</b>	<b>112-114%</b>
• <b>3000-3200 Meters</b>	<b>102-100%</b>
• <b>5000 Meters</b>	<b>97%</b>

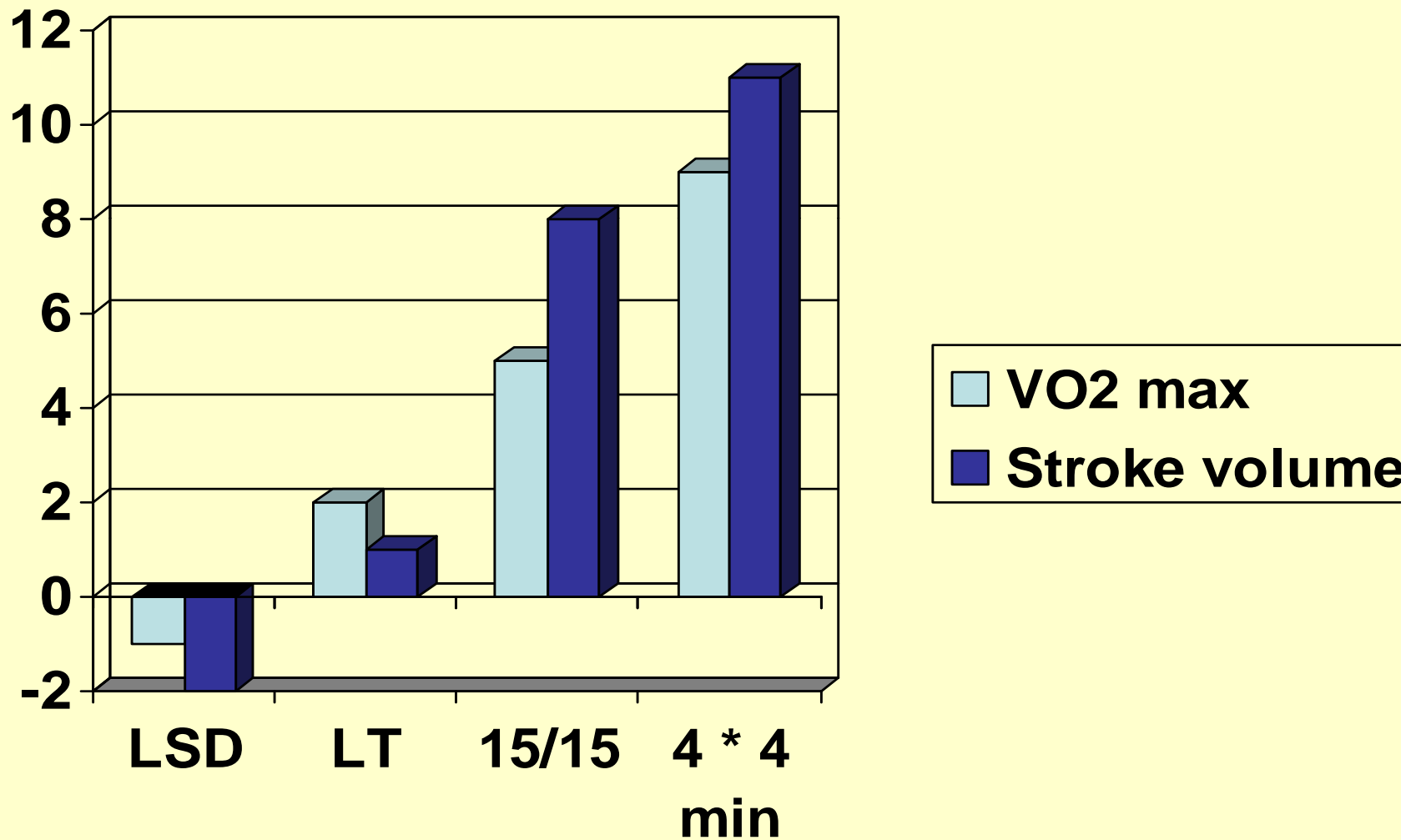
*VO<sub>2</sub> max Training Study*  
*12 week Training Period*  
*(Helgerud et al, 2007)*

- LSD: CR for 45 min @70% VO<sub>2</sub> max
  - LT: CR for 25 min @85% VO<sub>2</sub> max
- 15/15: 47 reps @90% HR max, 15 s rest
  - 4\*4 min: 4 min repeats @ VO<sub>2</sub> max

*Workout repeated twice per week, 40 mile weeks.*

# % Change $\text{VO}_2$ max & Stroke Volume (12 Weeks)

Helgerud et al, 2007, MSSE



# Pre/Post Physiological Changes

	Pre <b>LSD</b>	Post <b>LSD</b>	Pre <b>LT</b>	Post <b>LT</b>	Pre <b>15/15</b>	Post <b>15/15</b>	Pre <b>4*4</b>	Post <b>4*4</b>
<b>VO<sub>2</sub> max</b>	55.8	53.8	59.6	60.8	60.5	64.4	55.5	61.4
<b>V<sub>E</sub> O<sub>2</sub></b>	150.6	153.3	148.8	153.6	147.5	160.3	150.7	164.8

# Deena Kastor's $v\dot{V}O_2$ max Development

- Tested  $\dot{V}O_2$  max :
  - Age 22 (1995)  $\dot{V}O_2$  max: 77.5 ml/kg/min
  - Age 27 (2000)  $\dot{V}O_2$  max: 80.5 ml/kg/min
  - Age 32 (2005)  $\dot{V}O_2$  max: 81.1 ml/kg/min
- Tested  $\dot{V}O_2$  uptake at Lactate Threshold:
  - Age 22 (1995) : 61.8 ml/kg/min (79%)
  - Age 27 (2000) : 62.2 ml/kg/min (79%)
  - Age 32 (2005) : 67.3 ml/kg/min (82%)

# VO<sub>2</sub> max Run

- A lab value and a field value.
- Each bout of work is 400-3200 meters.
- Total volume is 3200-8000 meters.
- Done as an interval style workout.
- *Pace is date specific.*
- *Rest equal to work.*



# Interval and Repetition Runs

- Used mainly for glycolytic and  $\text{VO}_2$  <sub>max</sub> development.
- 30 meters to race distance.
- Barefoot grass runs.
- Rest dictates training effect.
- Efficiency early.
- Capacity late.



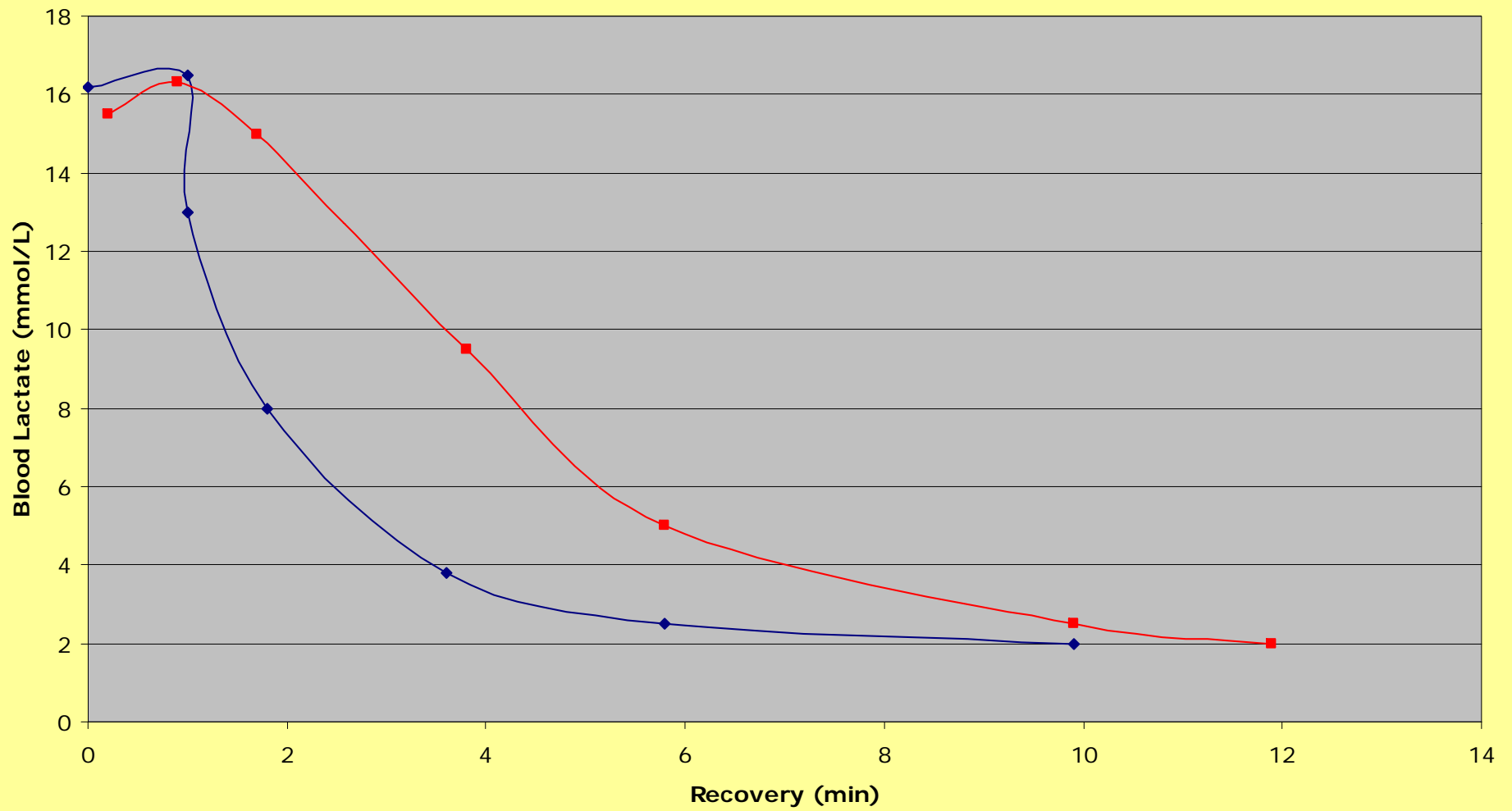
# Glycolytic Training Parameters

- **Efficiency** work done first 2/3 of season.
- **Capacity** work done last 1/3 of season.
- **Efficiency** work done as interval runs.
- **Capacity** work done as repetition runs.



# Recovery And Blood Lactate Levels

◆ Active Recovery    ■ Passive Recovery



# The Multi-Paced Training Scheme

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# The 5 Paces of the Multi-Paced Training Scheme for the 800/1600.

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- *Adapted from: Frank Horwill, Peter Coe, and Sebastian Coe*

# *Improvements in Ground Contact Time*

“If a distance runner can lessen their ground contact time by .02 seconds per stride, with all else being equal, there should be a ~5 second improvement in 1600 meter performance. This can be accomplished by strengthening the muscles of the foot.”

Ralph Mann Ph.D.

# Special Endurance 2 Work *Done on the Grass*

- Used on a regular basis it will strengthen the muscles of the foot.
- Athletic fields or grassy parks can be set up with cones to provide a 500-600 meter course.



# 12 Day Multi-Paced Microcycle

- Day 1:  $\text{VO}_2$  max
- Day 2: Hills
- Day 3: Long Run
- Day 4: Special 1
- Day 5: Recovery Run
- Day 6: Race
- Day 7: Special 2
- Day 8: Tempo Run
- Day 9: Recovery Run
- Day 10: Speed Endur.
- Day 11: Recovery Run
- Day 12: Speed

# Cornerstone Workouts

- 4 \* 1 mi @  $VO_2$  max pace
- 7 \* 800 @  $VO_2$  max pace
- 8 \* 90 sec runs on grass
- 8 \* 400 with 3 min rest
- 6 \* 150 with 4 min rest
- 8 \* 400 with 45 sec rest
- 15 \* flying 30 meters
- 4 \* 500 with 15 min rest
- 8 \* 200 with 8 min rest
- 2 \* 3 \* 300 with 3 min rest
- $VO_2$  max
- $VO_2$  max
- Special Endurance 2
- Special Endurance 2
- Speed Endurance
- Special Endurance 2
- Speed
- Special Endurance 2
- Special Endurance 1
- Special Endurance 1



# $\text{VO}_2$ max Workout #1

- Active 3 mile warm-up run.
- Extent is 4 \* 1 mile.
- Pace is *PRESENT DAY* 3200 max effort.
- Use a conversion table or a  $\dot{V}_{\text{dot}}$  (Jack Daniels) value to determine work effort from another race value.
- Rest is equal to work.
- 2 mile jog.

## $\text{VO}_2$ max Workout #2

- Active 3 mile warm-up run.
- Extent is 7 \* 800 meters.
- Pace is *PRESENT DAY* 3200 max effort.
- Use a conversion table or a  $\dot{V}_{\text{dot}}$  (Jack Daniels) value to determine work effort from another race mark.
- *Rest is equal to work.*
- 2 mile jog.

# Special Endurance 2 Workout #1

- 2 mile active warm-up.
- Using 5 cones set up a 500-600 meter course on the grass of several side by side soccer fields or a park.
- Have the runners barefoot during the repeats.
- Extent of run is 8 \* 600 with near max effort.
- Vary the rest so that the athletes run all 8 at about the same time. Start with 3 minutes rest and gradually move to 4-5 minutes rest between.
- 2 mile jog.

# Special Endurance 2 Workout #2

- 2 mile active warm-up.
- Several very fast strides.
- Extent of work is 8 \* 400 meters at near max effort on the track.
- Rest is 3 minutes.
- Time goal is ~5 seconds faster than *PRESENT DAY* 1600 pace.
- 2 mile jog.

# Speed Endurance Workout

- *With a measuring wheel and can of spray paint, mark a dot on the track exactly 150 meters from the finish line.*
- 2 mile very active warm-up.
- Extent of work is 6 \* 150 meters on the track at max effort. Use a starting device.
- Rest is 4 minutes.
- Time goal is their *PRESENT DAY* 400 meter time multiplied by .35.
- 3 mile easy run.

# Speed Workout

- 2 mile active warm-up.
- Several active strides.
- Flying 30 meter repeats on the track.
- Work is max effort.
- 4 minutes jog rest between repeats.
- Do up to 12 reps.
- 4 mile easy run.



# Special Endurance 2 Workout #4

- *Capacity work done as repetition running.*
- 2 mile active warm-up.
- Several active strides.
- Extent of work is 4 \* 500 at max effort.
- Rest is near complete at 15 minutes.
- Time goal is *PRESENT DAY* 800 pace multiplied by .59.
- 1 mile jog.

# Special Endurance 1 Workout #1

- 2 mile active warm-up.
- Several very active strides.
- Extent of work is 8 \* 200 at near max effort on the track.
- Rest is extensive at 8 minutes between repeats.
- Time goal is *PRESENT DAY* 400 meter pace multiplied by .47.
- 2 mile jog.



# Special Endurance 1 Workout #2

- 2 mile active warm-up.
- Several very active strides.
- Extent of work is 2 sets of 3 repeats of 300 meters on the track.
- Rest is incomplete at 3 min between repeats and 5 minutes between the sets.
- Time goal is **seasonal 800 goal pace** multiplied by .35.
- 2 mile jog.

▪

# *Regeneration Timeframe*

## 24 hours

- Normal long runs, strength runs, recovery runs, moderate tempo runs, alactic runs

## 48 hours

- Races, long runs plus, lactate threshold runs, basic glycolytic, strong tempo runs,  $\dot{V}O_2$  max

## 72 hours

- Long races, very strong glycolytic, very strong or long tempo runs

# Training Effects

- Some physiological effects after 24 hours.
- Full physiological effects after 20 days.
- Periodize and sequence your workouts so they fit the race schedule.
- The body is very resilient when at a high fitness level.
- Watch for muscle trauma caused by too much testosterone.

*More Endurance Information  
Available in the Following Book:*

*The Complete Guide to Track and  
Field Conditioning for Endurance  
Events.*

*By Scott Christensen*



[Athletesacceleration.com/trackandfieldendurance.html](http://Athletesacceleration.com/trackandfieldendurance.html)