

Run (and Eat) For Your Life



Mark Cucuzzella MD
Professor of Family Medicine
West Virginia University
Lt Col USAF Reserves

Mile 30 2015 JFK 50 Mile Run
12 yo Andrew Craig pacing ☺

Disclosures

- I own a small shoe store



Two Rivers Treads

RUN • WALK • HEALTH

“The Human Body Is Centuries Ahead Of The Physiologists” Sir Roger Bannister

“Doctors and scientists said that breaking the four-minute mile was impossible, that one would die in the attempt.”



Kids Running Revolution

My wish is that I planted a seed and created some space. Let the seed grow and fill the space.

Why do My Feet Hurt 2000?

“A man’s errors are his portals of discovery” James Joyce





Two roads diverged
in a wood and I--

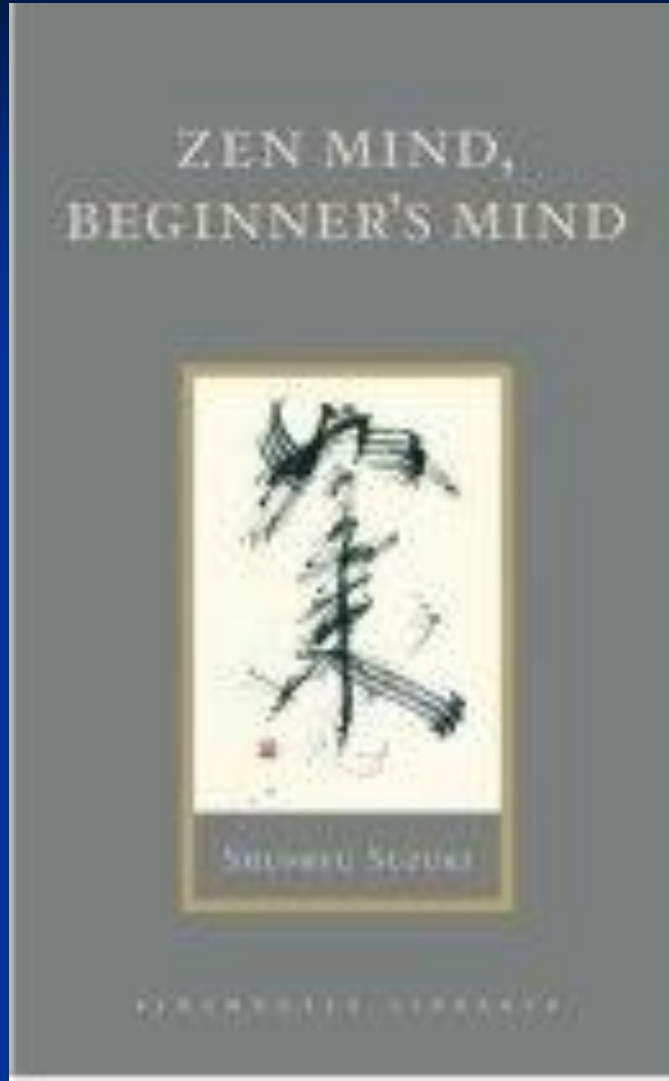
I took the one
less travelled by.

And that has made
all the difference.

~ Robert Frost.

Which Road Do You Take?





"In the beginner's mind there are many possibilities, but in the expert's there are few."

“A Beautiful Medicine” by John Mercier

1. Controlling- treatment after an trauma; full control by medical side
2. substitutive- take a med to treat a symptom assuming the body does not have capacity to heal itself
3. catalytic - support the body and empower it to reverse and heal dz

Functional Classification of the Species Homo Sapiens

- Homo Sedentary
 - Difficulty erecting from the seated condition
 - Victim mentality, it is not his responsibility
 - Taking medication to resolve
- Homo Dysfunctional
 - Difficulty performing base movements but at least moves
 - Performance gains made because something is better than nothing.
 - Very likely to be injured if physically challenged
 - Lunges are considered strenuous and challenging and maybe damaging.

■ Homo Sapiens

- Likely physically active from birth
- Not plagued by the 3C's (Chairs, cars, computers)
- Injuries likely from trauma
- If urban dwelling then is trained and conditioned by a Homo Competent or Homo Badass.
- Multiplanar lunges are becoming a warm up
- This should be the norm!

■ Homo Competent

- Performance orientated evolution of the species
- Moves with agility, purpose and competence
- Has long since left the confines of machine based exercise
- Movement does not create dysfunction it improves it.
- Knowledge of movement is being transcended by experience and competence.

Finally.....

■ Homo Badass

- Competently moves more than his body weight
- Strength and competence translates into improved athletic performance
- Can only relate to other members of the species!

Captain Samantha Wood



Sam Doing Some Fat Adapted Badass Stuff



My Family Is Designed For Heart Disease And Diabetes



Fit But Not Healthy



**2006 age 40 Burning Bagels
uberfit but not healthy
Fasting BG 120's
TG >200 HDL 40's**



**2011 Age 45 Burning Butter
Little Less Fit But Healthier
Labs improving. Feel Better**

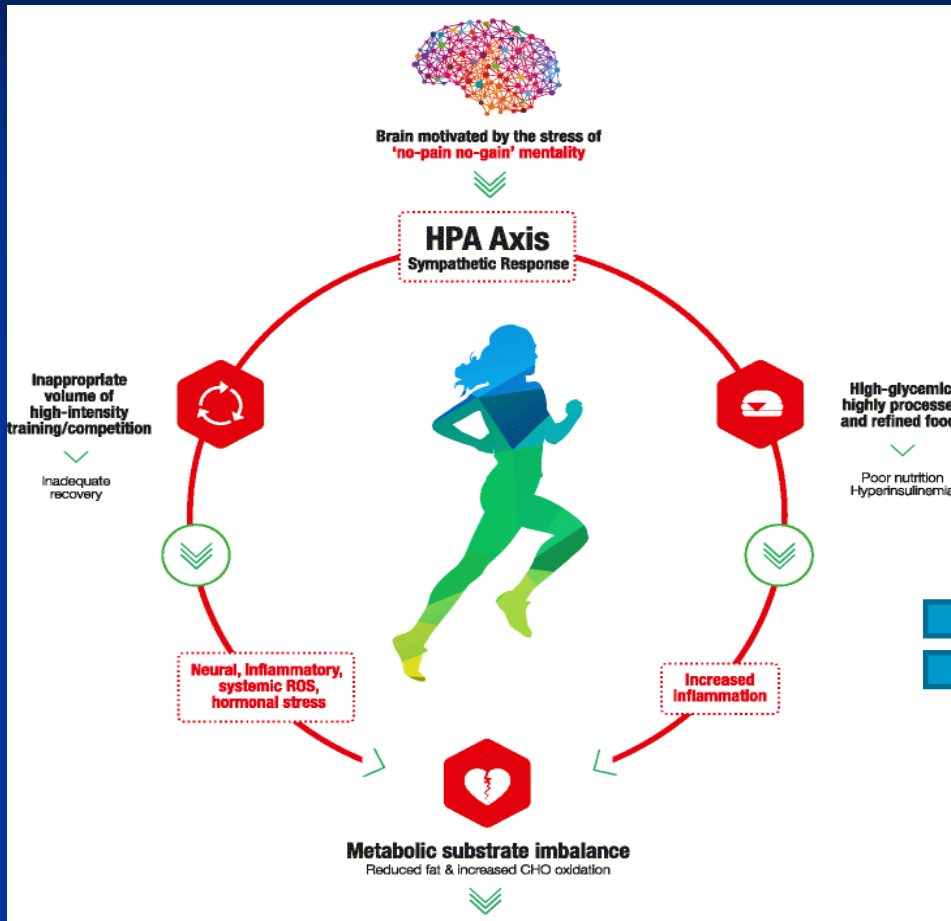
Pre 2010- this was breakfast, bedtime, 2am
and my “bowl” was a large tuperware



Dr. Phil Maffetone

Fit But Unhealthy

Training and Eating Paradigm



**2017 Not As Fit But Healthy-
Continued Human Experiment
HDL 106 LDL 65 TG 67 But **A1C still 6.3**
All Inflammatory Markers Clean!**

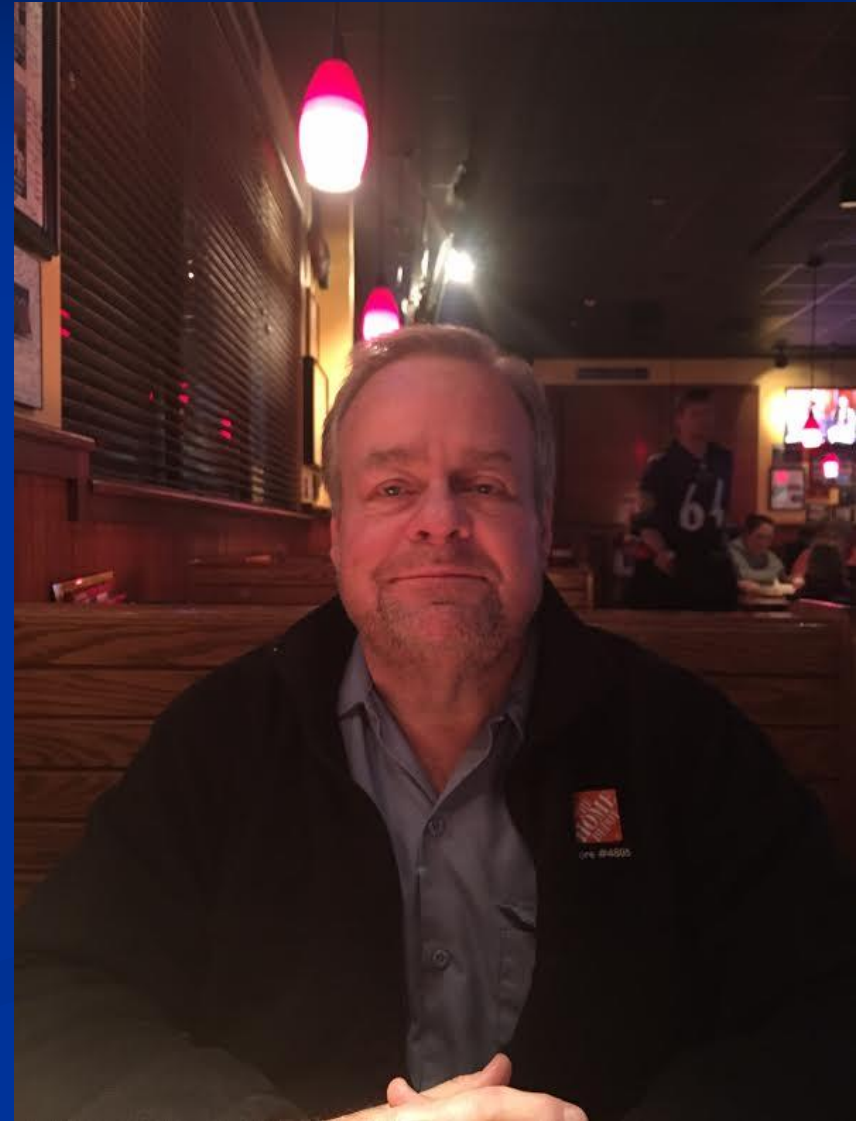


Marine Corps Marathon 2016



Be a Lab Rat

Steve Williams 85 lbs – One Year Later “Meds in the Trash”



Passing the Stress Test and NO Diabetes



Terry Caswell

50 lbs and over 12 inches



Half the Men They Used to Be



Running To Recover



Many Runners Can Burn Carbs Just Fine! Friends Mike Wardian and Jim Walmsley



Matt Fitzgerald “The Endurance Diet”

“Those who fall for low carbohydrate diets commonly develop symptoms of over training, the worst of which are persistent lethargy, decline in performance, hormonal disruptions, and sleep and mood disturbances. **Sad to say, the rising popularity of low-carb diet among recreational endurance athletes has been very good for my business as a sports nutritionist.**”

Liz Applegate Series of 3

NUTRITION & WEIGHT LOSS FRIDGE WISDOM

Ultrarunners Burn Carbs as Fuel

A small study found that fat-burning may not be as effective as people think.

By [Liz Applegate, Ph.D.](#) WEDNESDAY, MAY 18, 2016, 3:11 PM



ADV

YOU MIGHT LIKE



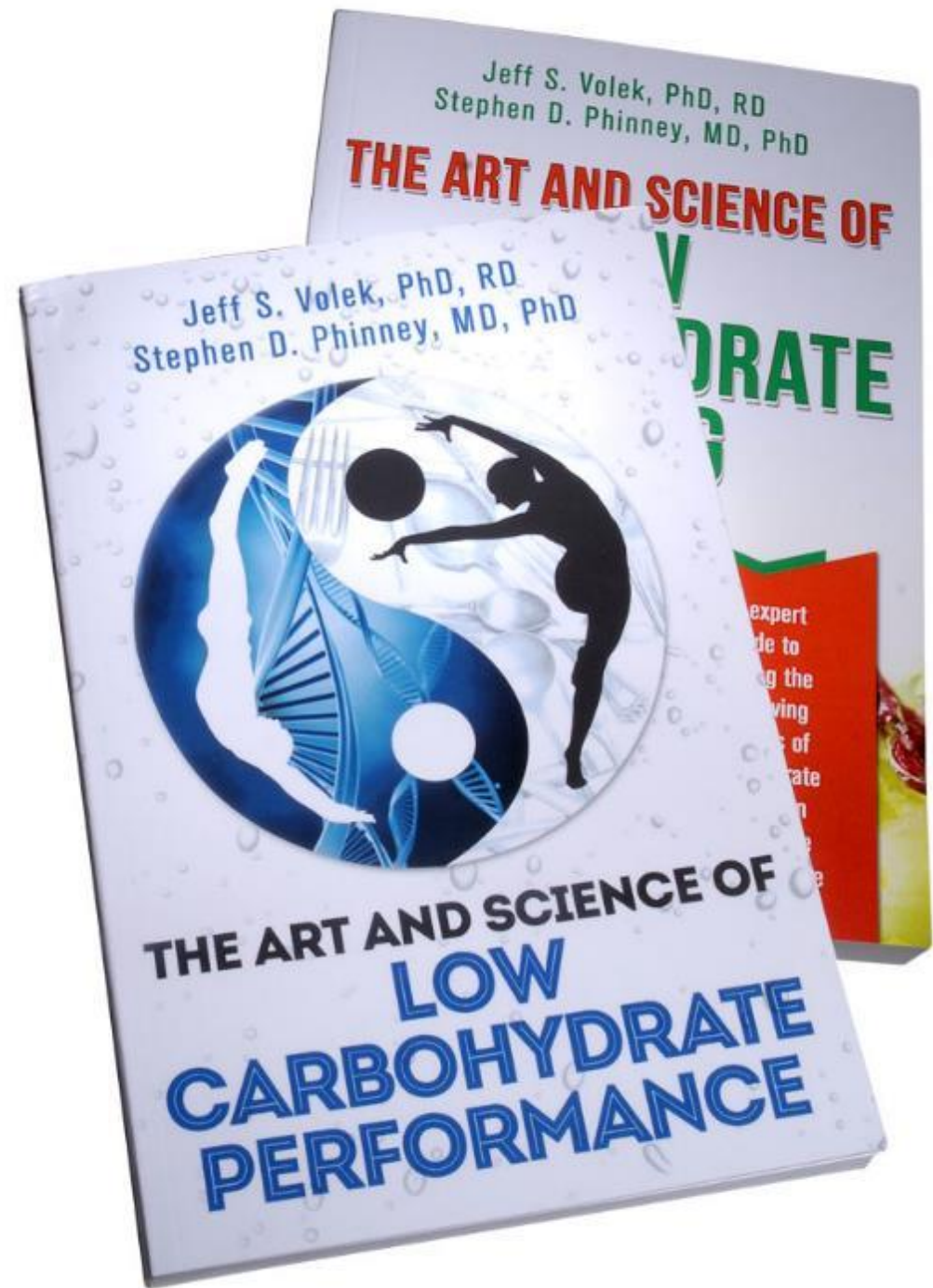
How
Every
Gund

<http://www.runnersworld.com/fridge-wisdom/ultrarunners-burn-carbs-as-fuel>

Many Thanks to
Steve and Jeff

Coined term “fat
adaptation” which
equals “metabolic
flexibility”

You Saved My Life



Dr. Tim Noakes



On Trial in
South Africa for
telling a mom its
ok for a baby to
have fat

Drink Before Thirst? Story of Dr. Cynthia Lucero



Jacques Anquetil- Steak, Lobster, Campagne



<https://decaironman-training.com/2014/01/23/yellow-jersey-training-what-we-have-learnt-from-cyclings-greats-24/>

IRONMAN®

Arizona TriTempo

PRESENTED BY

8:51:28

TIMEX

WM
WASTE MANAGEMENT

ACTIVE

ACTIVE

EarthLink®

SUGOI

ENDURANCE

NEWTON
running

RŌKA®

LIFEPROOF
LET'S GO!

TRAINING
PEAKS

GU

WM
WASTE MANAGEMENT



Rethinking fat as a fuel for endurance exercise

JEFF S. VOLEK¹, TIMOTHY NOAKES², & STEPHEN D. PHINNEY³

¹Kinesiology Program, Department of Human Sciences, The Ohio State University, Columbus, OH, USA, ²Discovery Health Professor of Exercise and Sports Science, Department of Human Biology, University of Cape Town and Sports Science Institute of South Africa, Newlands, South Africa, ³School of Medicine (Emeritus), University of California Davis, Davis, CA, USA

Western States 100 mile
course record



Tim Olsen

American record for running
100 miles (11:47:21)



Zach Bitter

American 24-hr distance
record (172.5 miles)



Mike Morton

Birds Fly More Than 7,000 Miles Nonstop In Its Annual Fall Migration, One Godwit Traveled From Alaska to New Zealand in Eight Days

Washington Post Wednesday, October 22, 2008



- The birds weigh no more than 1.5 pounds when they leave. Half of that is fat, which they burn off completely during the flight

The Mighty Sled Dog- 100 miles at 8 min/mile....repeat



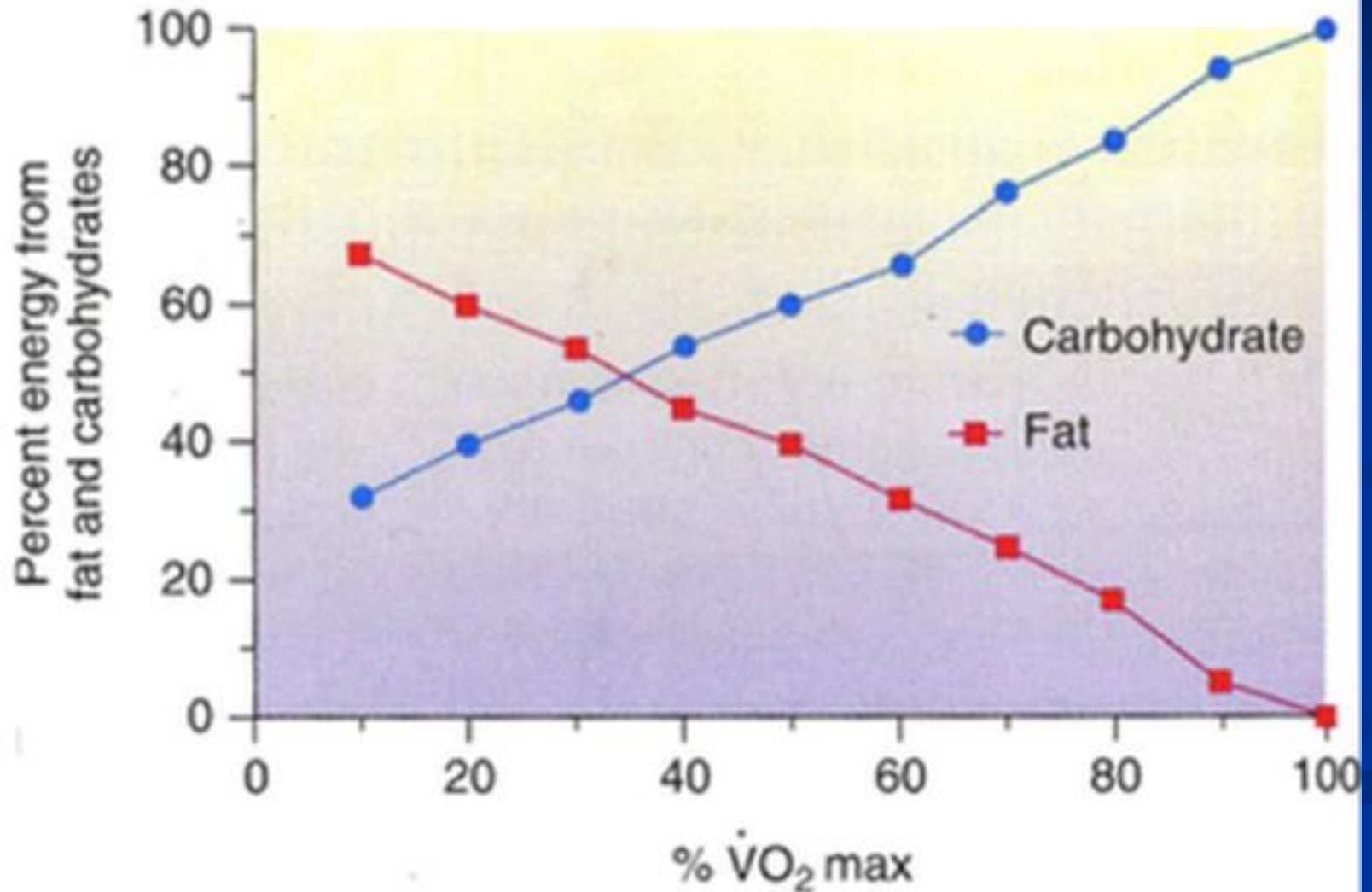
- dogs 70 percent more mitochondria per cell than humans
- cells can convert fat far more efficiently
- Each human muscle cell contains up to 2500 mitochondria.
- VO_2 max 300 ml/kg/min.

2017 Continued Human Experiment You Need Objective Measurements



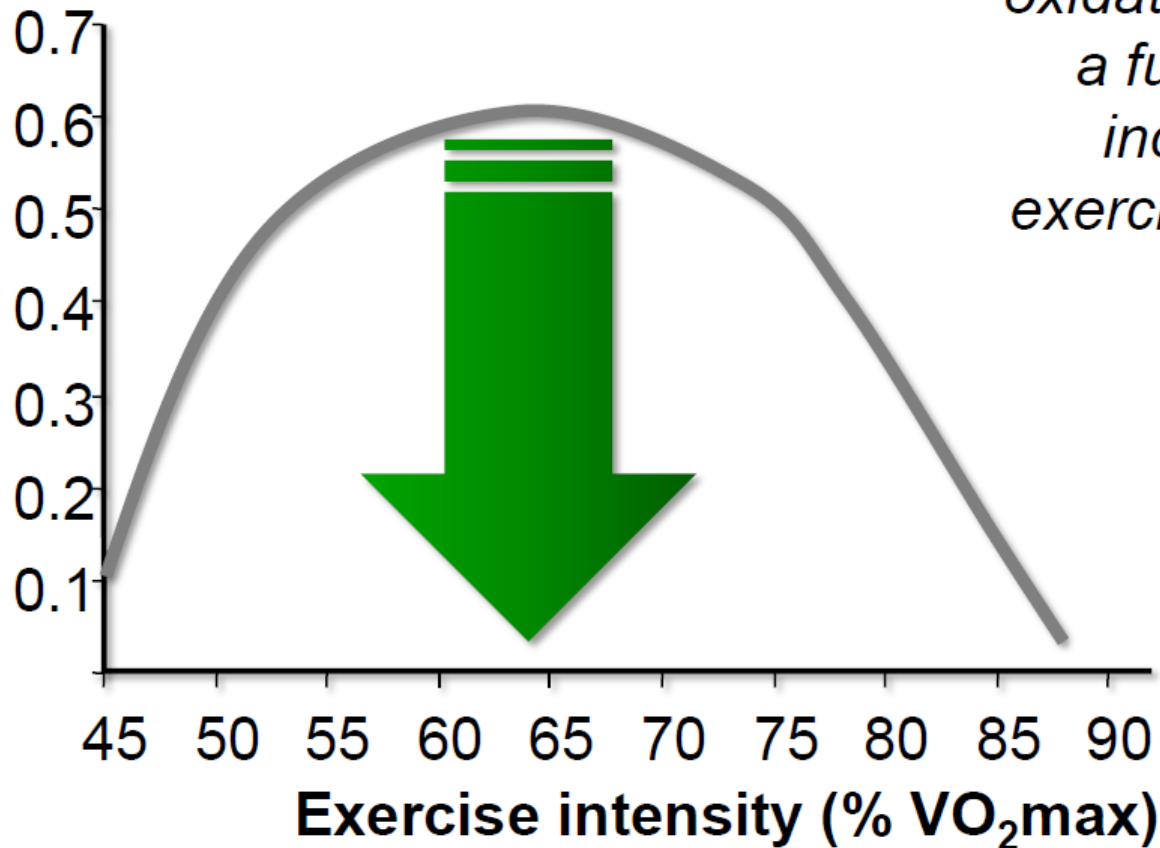


Crossover Point



Peak Fat Oxidation- Consensus View

Fat oxidation
(g/min)



*Typical fat
oxidation rates as
a function of
increasing
exercise intensity*

FASTER Study

Fat Adapted Substrate Oxidation in Trained Elite Runners

METABOLISM CLINICAL AND EXPERIMENTAL 65 (2016) 100–110



ELSEVIER

Available online at www.sciencedirect.com

Metabolism

www.metabolismjournal.com



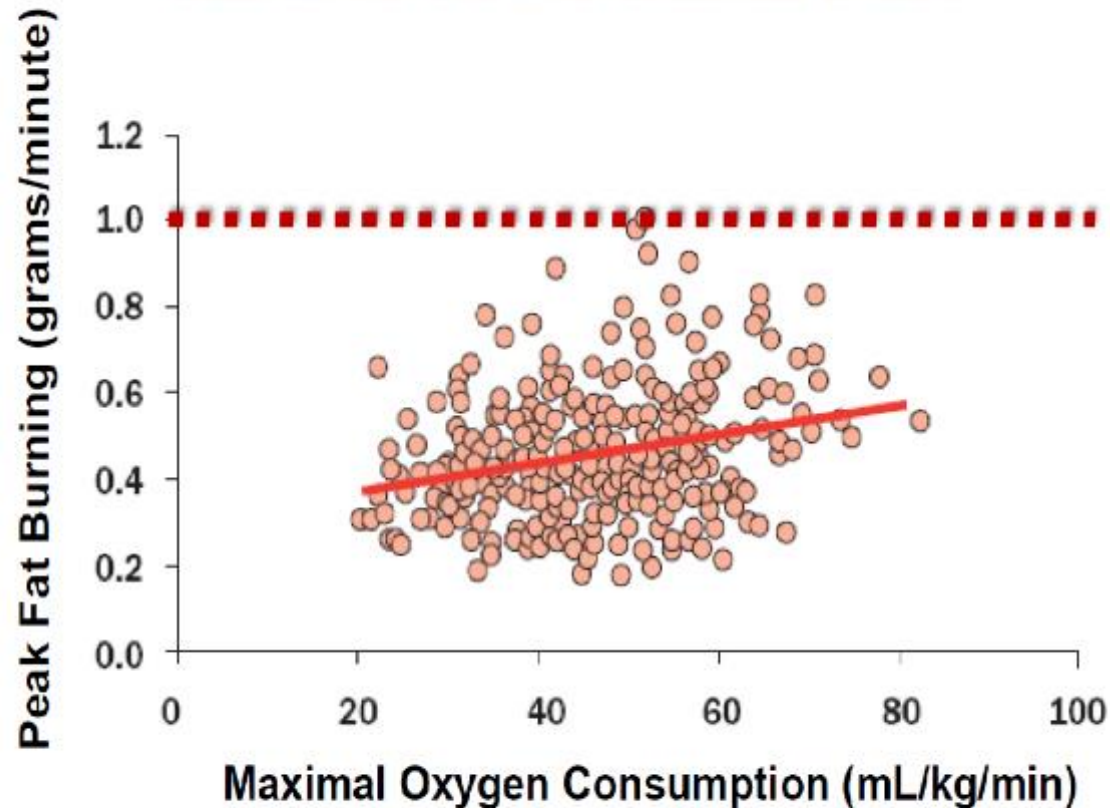
Metabolic characteristics of keto-adapted ultra-endurance runners



Jeff S. Volek^{a,b,*}, Daniel J. Freidenreich^{a,b}, Catherine Saenz^{a,b}, Laura J. Kunces^a, Brent C. Creighton^a, Jenna M. Bartley^a, Patrick M. Davitt^a, Colleen X. Munoz^a, Jeffrey M. Anderson^a, Carl M. Maresh^{a,b}, Elaine C. Lee^a, Mark D. Schuenke^c, Giselle Aerni^a, William J. Kraemer^{a,b}, Stephen D. Phinney^d

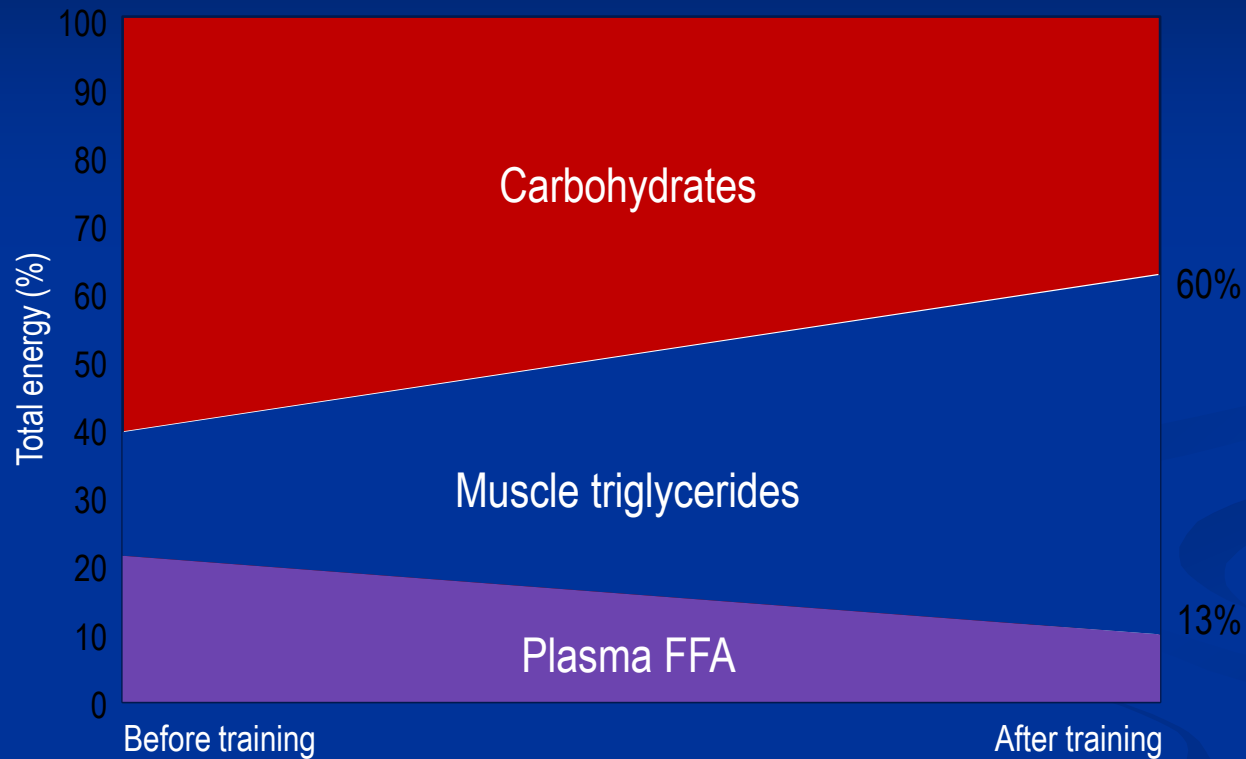
Pre FASTER Era

How Much Fat Can Humans Burn?



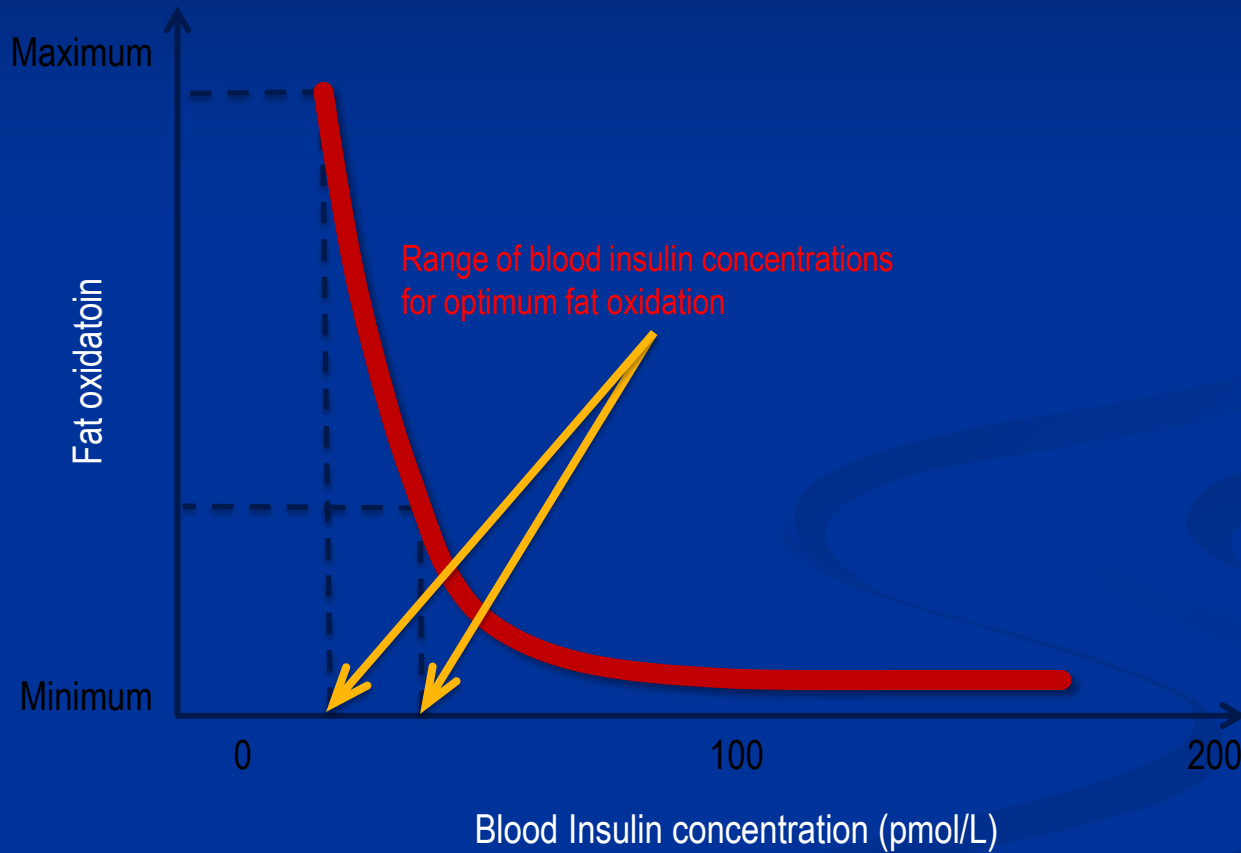
Data from Venables et al. Determinants of fat oxidation during exercise in healthy men and women: a cross-sectional study. *J Appl Physiol.* 98:160-7, 2005. www.poonline.co.uk/encyc/fat-burning-using-body-fat-instead-of-carbohydrates-as-fuel-40844

TRAINING: EFFECTS ON FUEL USE DURING EXERCISE



Martin et al., 1993.

FAT OXIDATION IS INHIBITED AT HIGH BLOOD INSULIN CONCENTRATIONS



Who Were The Subjects- Homo Badass

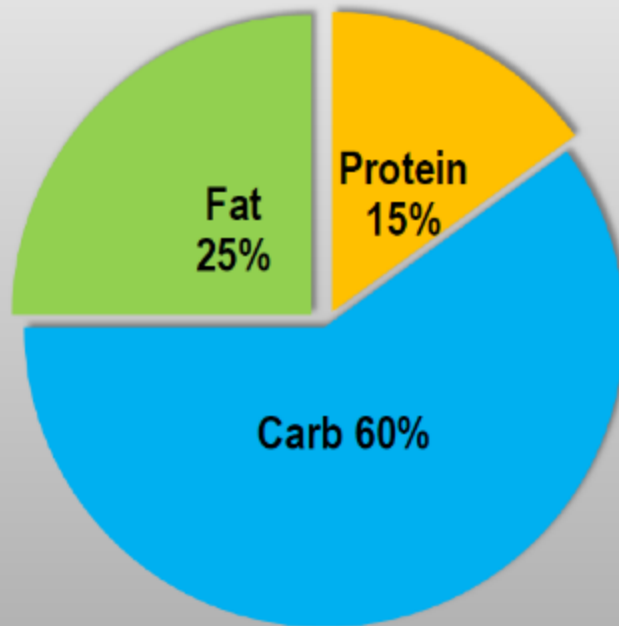
Subject Characteristics

	HCD (<i>n</i> = 10)		LCD (<i>n</i> = 10)	
	Mean	Range	Mean	Range
Age (<i>yr</i>)	33	22 - 40	34	21 - 45
Height (<i>cm</i>)	173.9	167.1 – 182.0	175.7	165.1 – 189.4
Body mass (<i>kg</i>)	66.5	57.9 - 79.9	68.8	55.5 - 81.6
Body fat (%)	9.6	4.7 - 15.5	7.8	4.5 - 12.3
Fat mass (<i>g</i>)	6,513	2,774 – 12,102	5,454	2,953 – 8,780
Lean mass (<i>kg</i>)	57.3	49.4 -64.2	60.9	50.2 – 71.7
VO ₂ max (<i>mL/kg/min</i>)	64.3	54.8 – 76.0	64.7	59.6 – 71.1
VO ₂ max (<i>L/min</i>)	4.25	3.34 – 4.86	4.41	3.78 – 4.95

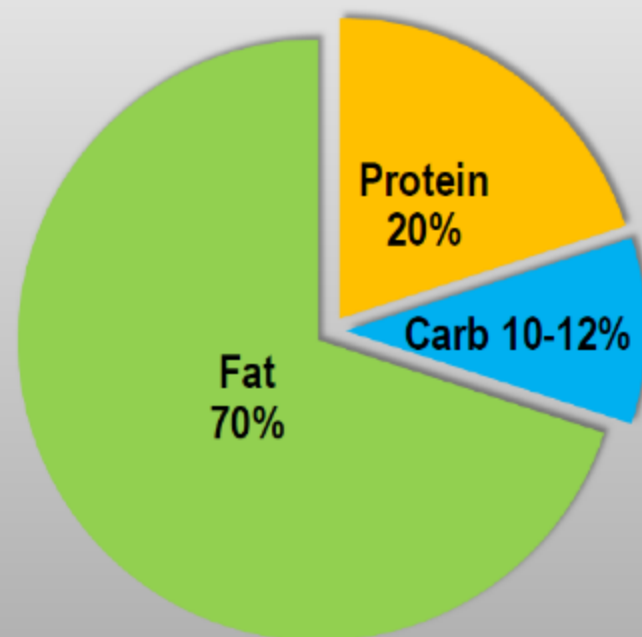
What Did They Eat?

Habitual Diets

**High-Carb
(HCD)**

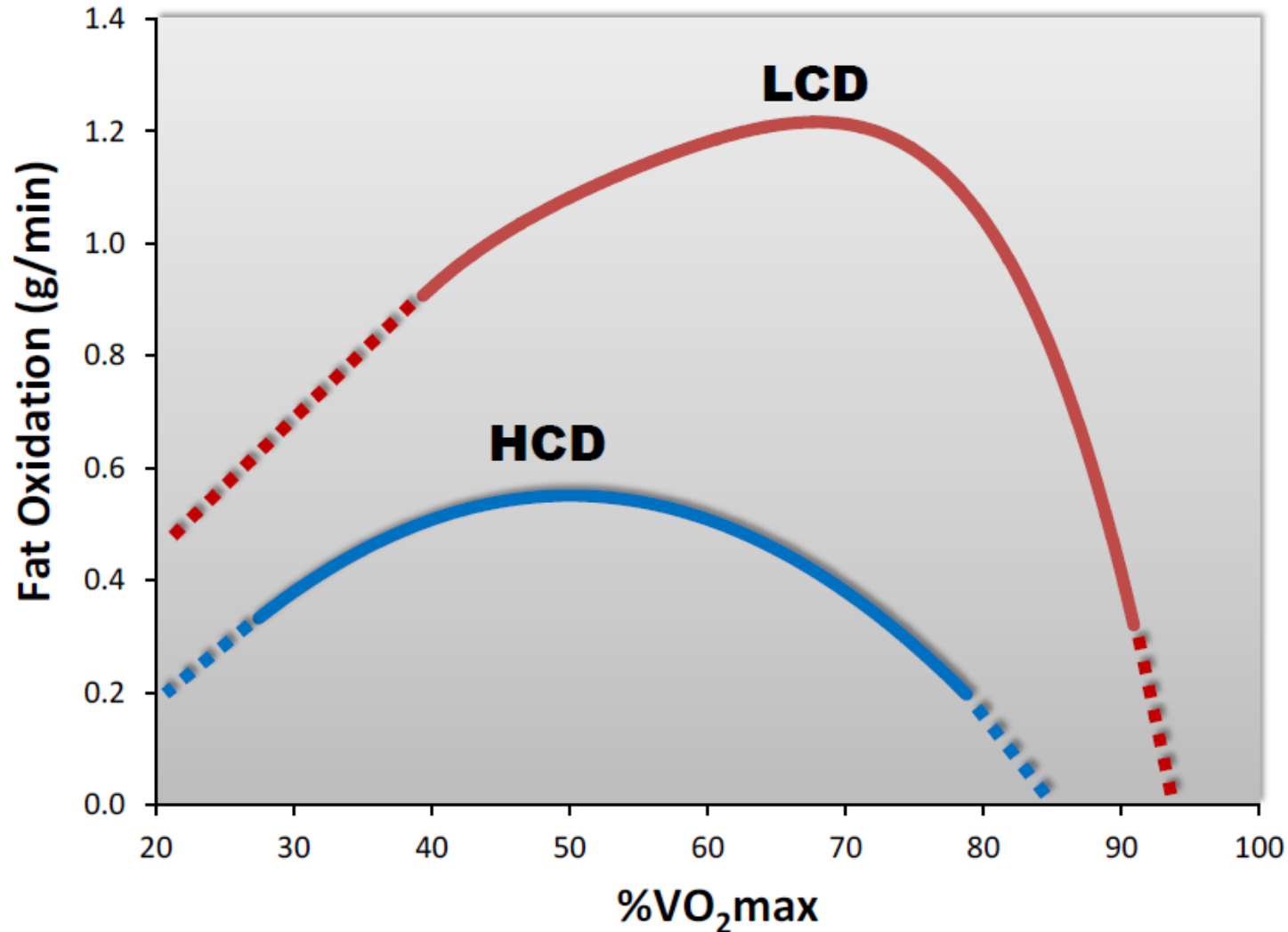


**Low-Carb
(LCD)**

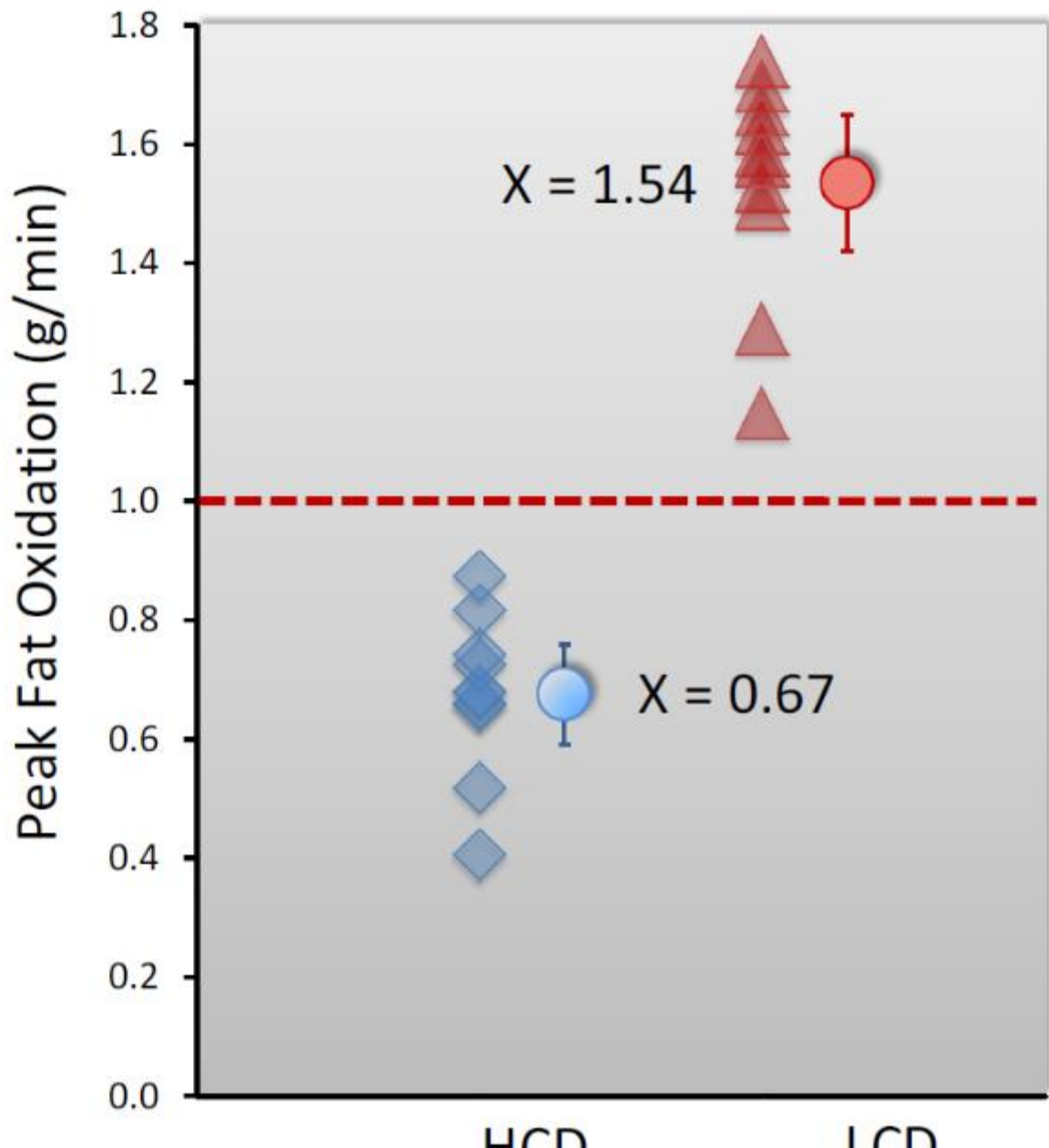


Fat Oxidation vs Intensity VO2 Max

Fat Oxidation Versus Exercise Intensity

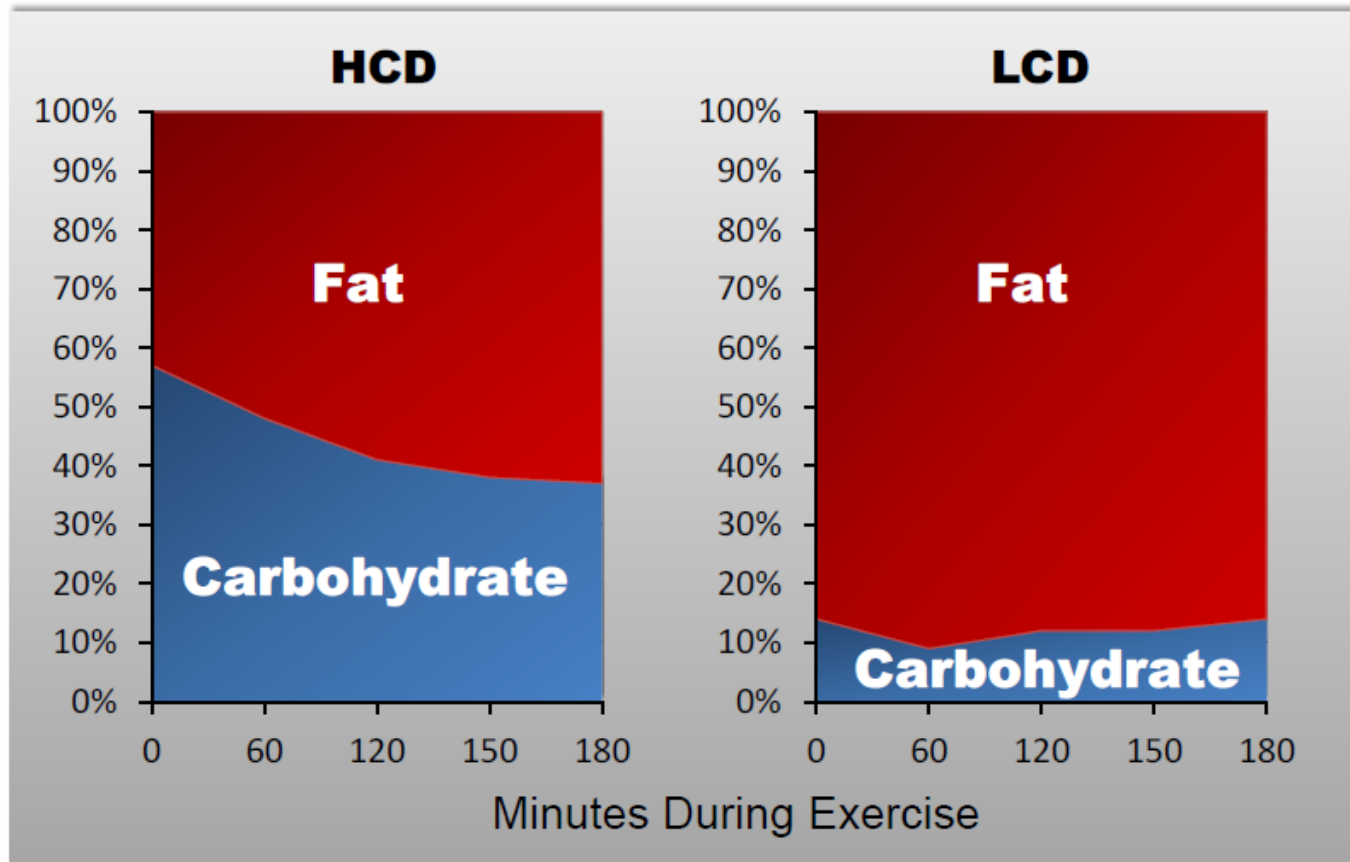


Results: Peak Fat Burning During VO₂max

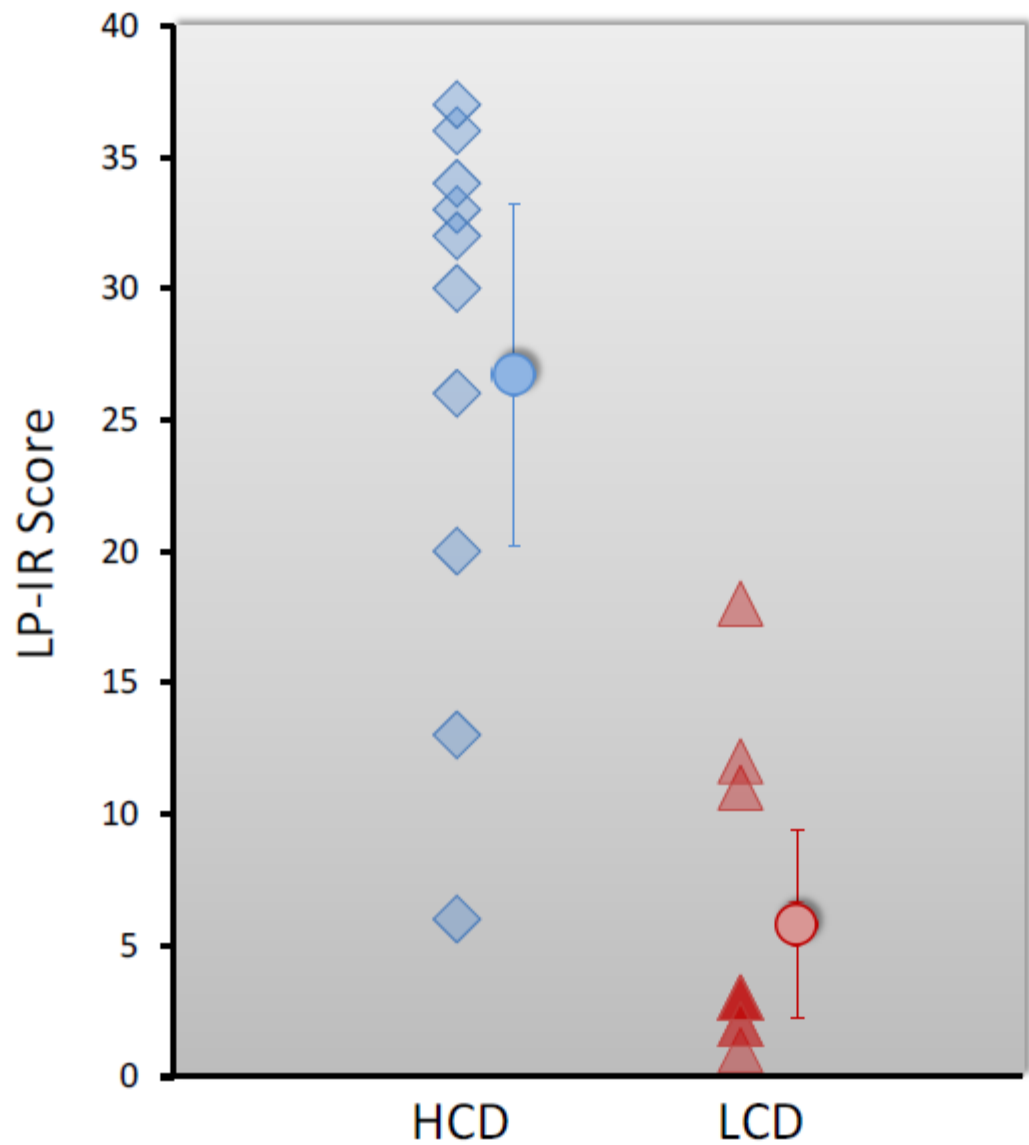


Carbs vs Fat 3 hour submax (64% VO₂)

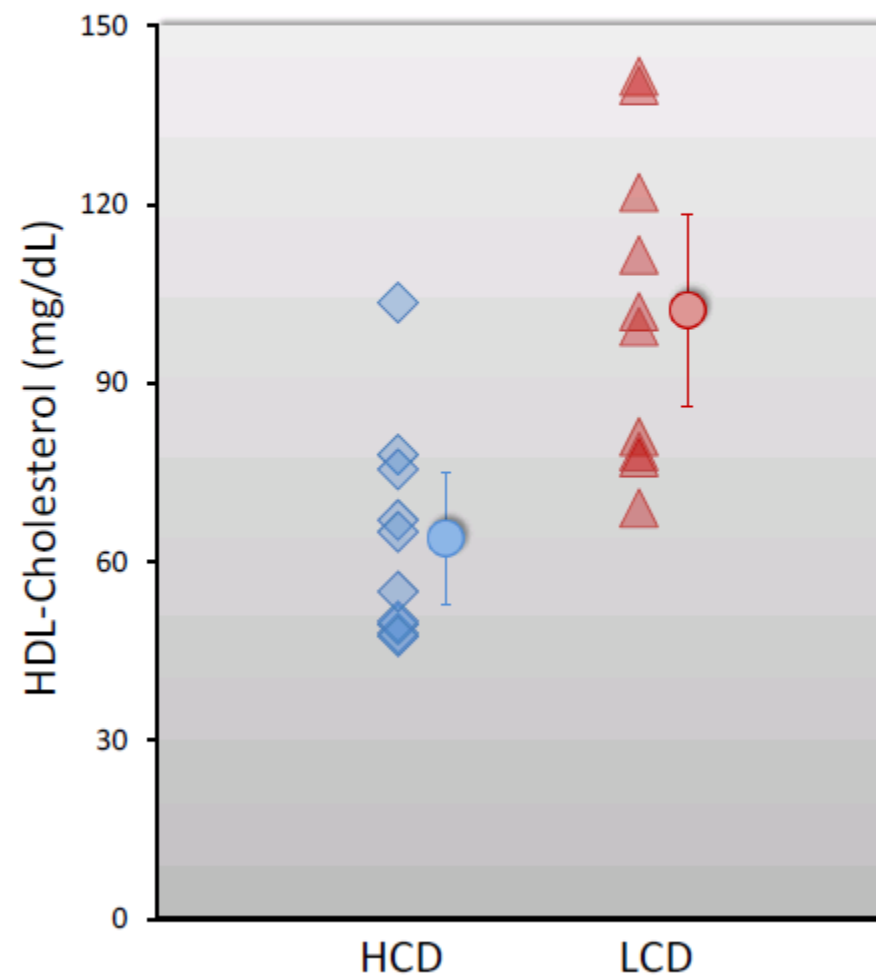
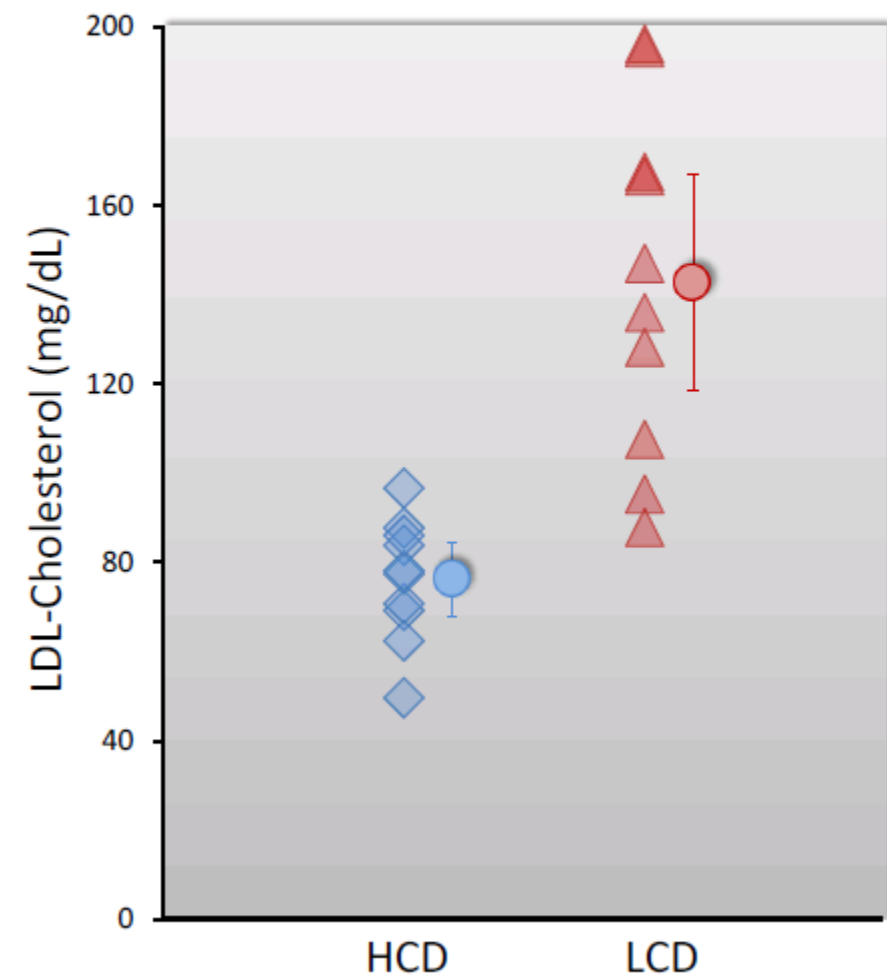
Fuel Use During Submaximal Exercise



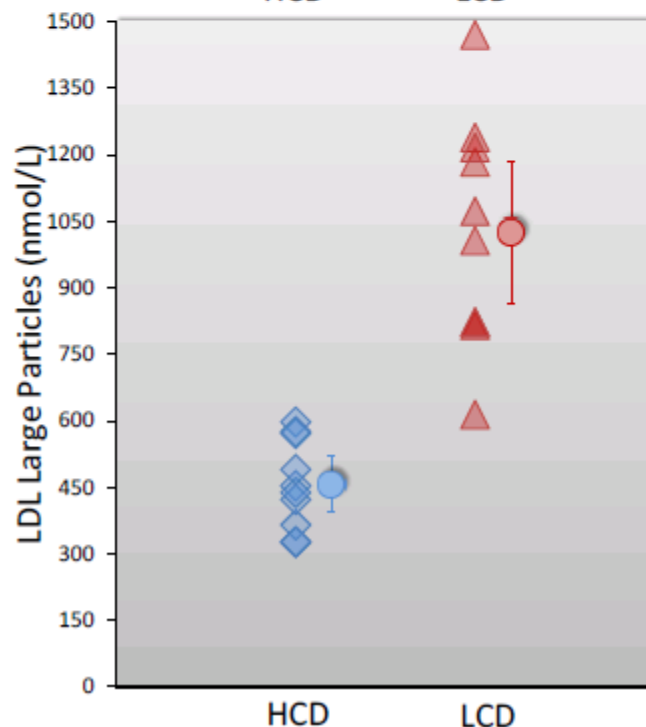
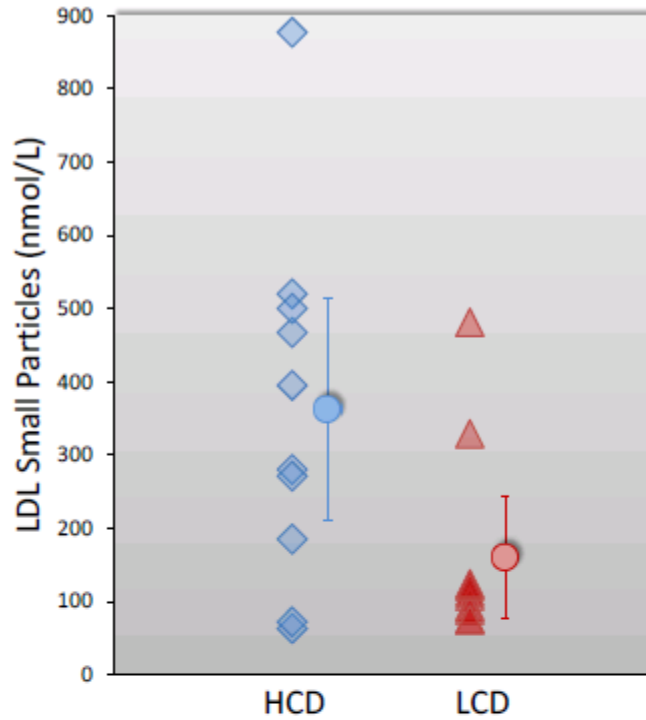
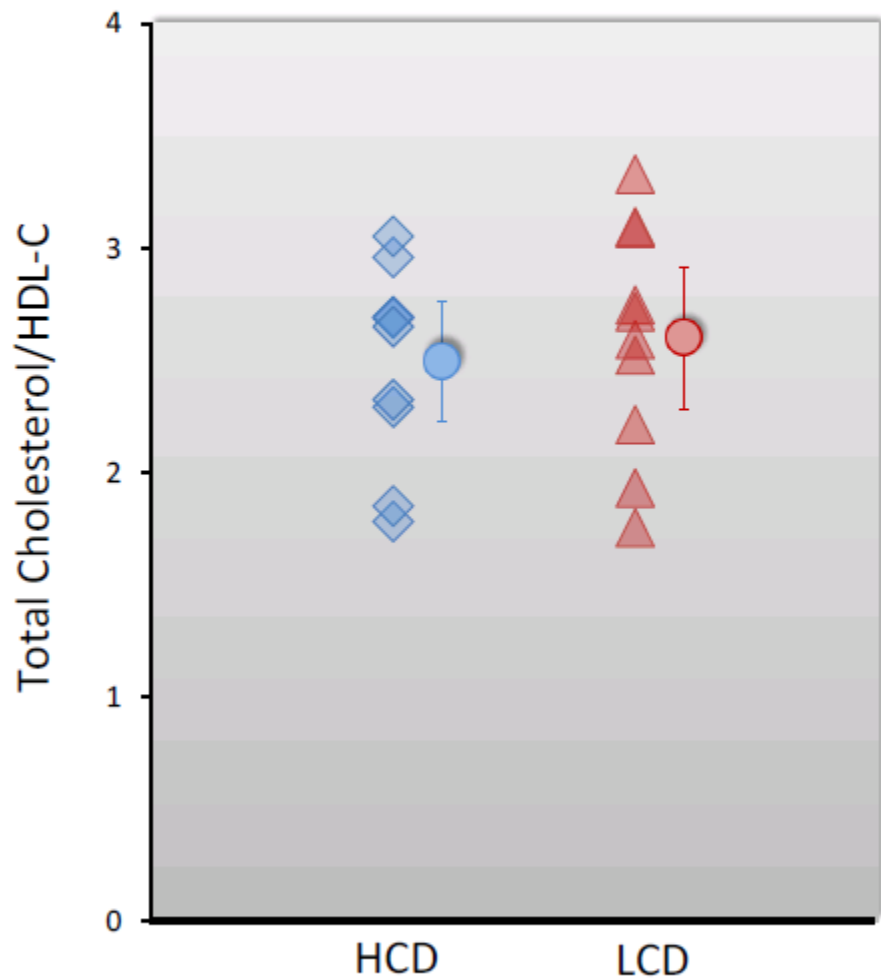
Results: Insulin Resistance



Results: Fasting LDL and HDL Cholesterol



Results: LDL Particle Concentrations



Can you run a marathon
at age 50 under 3 hours
barefoot and in 3oz
sandals
and on bacon and eggs?



Marine Corps Marathon 2016



MARATHON - MARATHON

CUCUZZELLA
DOSTOWN, WV

2:55:26
Division 1 Gender 78 Overall 81

Location	Net Time	Clock Time	Pace	Pace Between
START	00:00			
5K	21:34	21:34	6:56 /mi	
10K	42:08	42:08	6:47 /mi	6:37 /mi
15K	1:02:19	1:02:19	6:41 /mi	6:29 /mi
20K	1:23:03	1:23:03	6:40 /mi	6:40 /mi
13.1	1:27:29	1:27:29	6:40 /mi	6:29 /mi
25K	1:44:02	1:44:02	6:41 /mi	6:49 /mi
30K	2:04:26	2:04:26	6:40 /mi	6:33 /mi
35K	2:25:12	2:25:12	6:40 /mi	6:40 /mi
40K	2:45:58	2:45:58	6:40 /mi	6:41 /mi
FINISH	2:55:26	2:55:26	6:41 /mi	6:56 /mi

How Bout 50 Miles?

JFK 50 Nov 19 2016



Do you need to “Carb Up”

Breakfast and on the course -50 Miles



Meb is Lowish Carb



Other than Real Food- Fueling Products of Value

- Vespa- Wasp Amino Acid
- Exogenous Ketones
- UCAN- Superstarch

Real Food List

Realmealrevolution.com

“the stinky omelet”



January 2016- Good Butter Burner

Target Workout Zones

The CardioCoach has analyzed your VO₂ Test and has created the following workout zones based on your results. Discuss with your trainer a workout strategy based on your goals and your Target Workout Intensity Zones.

Low Zone	Moderate Zone	High Zone	Peak Zone
HR: 79-134	HR: 134-144	HR: 144-172	HR: 172-181
C/Hr: 97-637	C/Hr: 637-789	C/Hr: 789-1088	C/Hr: 1088-1188

*HR = Heart Rate; C/Hr = kcal per hour

FAT

SUGAR

Recovery Heart Rate

RECOVERY

	Peak	1 Minute	2 Minute
Heart Rate	181	179 (2%)	139 (42%)

Cardio Strength

AnAer. Threshold

	Start	AeT	AT	Peak
VO ₂ (ml O ₂ /kg/min)	5.3	34.7	41.4	64.8
Heart Rate (bpm)	79	134	144	181
Calories Per Hour	97	637	789	1188
Fitness Level	Superior			

AeT = Aerobic Threshold, AT = Anaerobic Threshold

CROSSOVER
FAT → SUGAR

VO₂ MAX

Fitness Level

Note fitness level is based on a VO₂ Max. Refer to fitness level tables on back side of page.

Age	VERY LOW	LOW	FAIR	GOOD	EXCELLENT	SUPERIOR
40-49	<30.2	30.2-33.5	33.6-38.9	39.0-43.7	43.8-48.0	>48.0*

FAT OX 2 1.189 min

Coach's Interpretation

Your target heart rate

Recommend testing again by:

Age:	49
Gender:	Male
Weight:	63.5 kg (140 lbs)
Height:	173 cm (5 ft 8 in)
BMI:	21.2
Test Type:	Other
Test ID:	30
SN:	14793

Name: Mark Cucuzella
Date: January 20, 2016 06:31
Coach:

Feb 2017- Butter Burning Beast 😊

Target Workout Zones

The CardioCoach has analyzed your VO₂ Test and has created the following workout zones based on your results. Discuss with your trainer a workout strategy based on your goals and your Target Workout Intensity Zones.

Low Zone	Moderate Zone	High Zone	Peak Zone
HR: 70-168	HR: 168-170	HR: 170-176	HR: 176-178
C/Hr: 139-1019	C/Hr: 1019-1143	C/Hr: 1143-1175	C/Hr: 1175-1185

FAT

SUGAR

*HR = Heart Rate, C/Hr = kcals per hour

Recovery Heart Rate

RECOVERY

	Peak	1 Minute	2 Minute
Heart Rate	178	113 (61%)	121 (53%)

Cardio Strength

ANAer. Threshold

	Start	AeT	AT	Peak
VO ₂ (ml O ₂ /kg/min)	7.5	55.6	60.0	64.6
Heart Rate (bpm)	70	168	170	178
Calories Per Hour	139	1019	1143	1185
Fitness Level	Superior			

CROSSOVER

VO₂ MAX

AeT = Aerobic Threshold, AT = Anaerobic Threshold

Fitness Level

Note fitness level is based on a VO₂ Max. Refer to fitness level tables on back side of page.

Age	VERY LOW	LOW	FAIR	GOOD	EXCELLENT	SUPERIOR
50-59	<26.1	26.1-30.9	31.0-35.7	35.8-40.9	41.0-45.3	>45.3*

FATOX ≈ 1.95/min

Coach's Interpretation

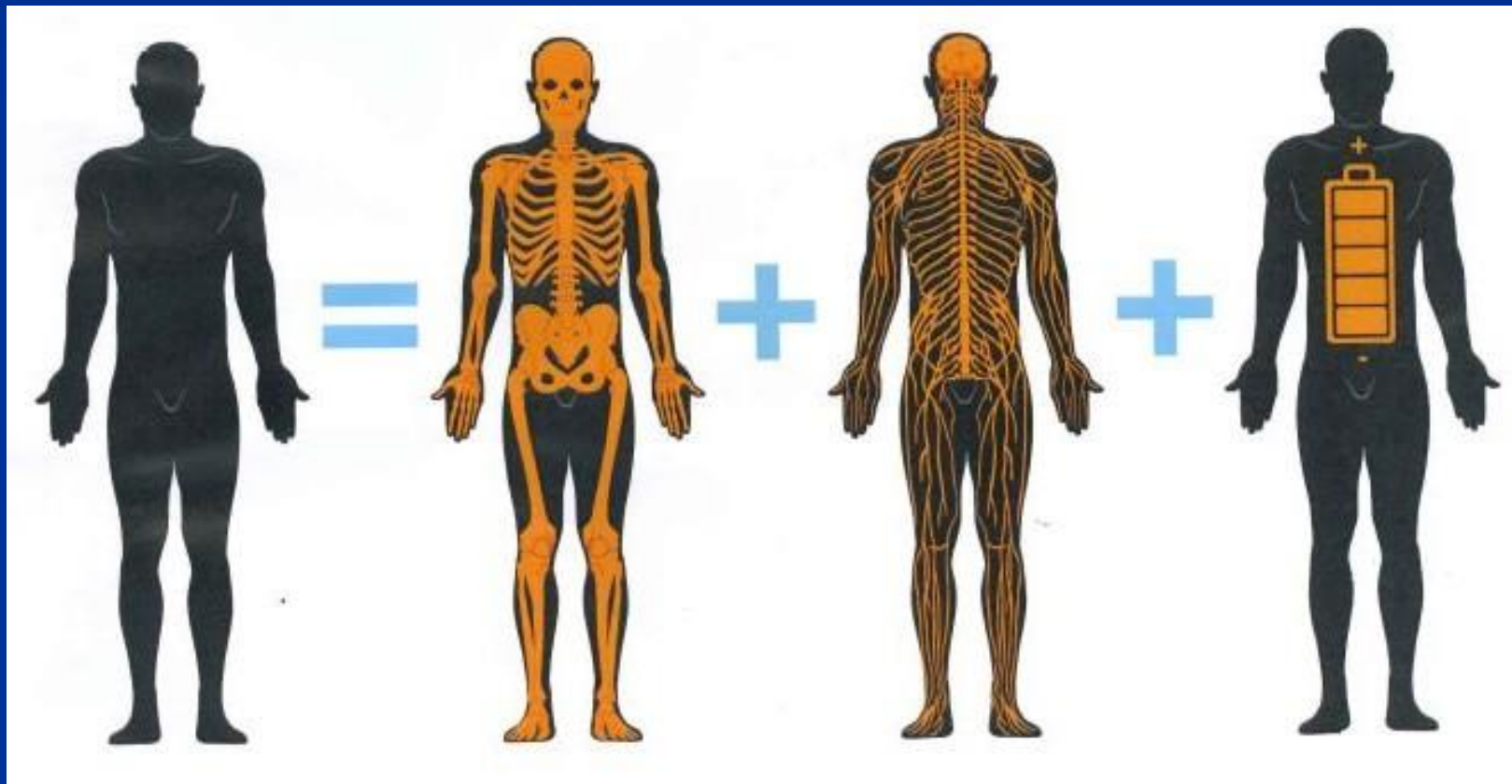
Your target heart rate

Recommend testing again by:

Age:	50
Gender:	Male
Weight:	63.5 kg (140 lbs)
Height:	173 cm (5 ft 8 in)
BMI:	21.2
Test Type:	Other
Test ID:	60
SN:	14793

Name: Mark Cucuzella
Date: February 15, 2017 11:10
Coach:

Optimal Human = Hardware + Software + Energy



Basic Military Training

$\frac{1}{4}$ Male and $\frac{1}{2}$ Female Sustain Injury



Mobility



Skill and Agility



Slow Jogging



Dynamic and Core Stability

Combat Controllers Lackland AFB

Running Should not Cause Injury

Running Should Make You Injury Resilient



57 Pounds Hurts Your Joints



What is Your Movement Practice?

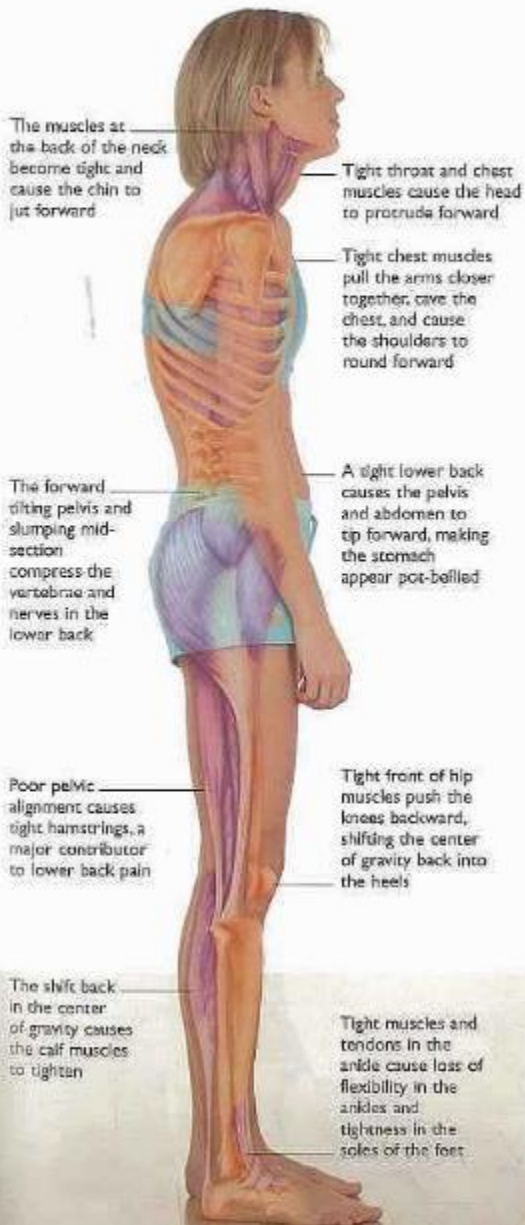
Movement

*What is
in Your
Menu?*

Exercise
Running

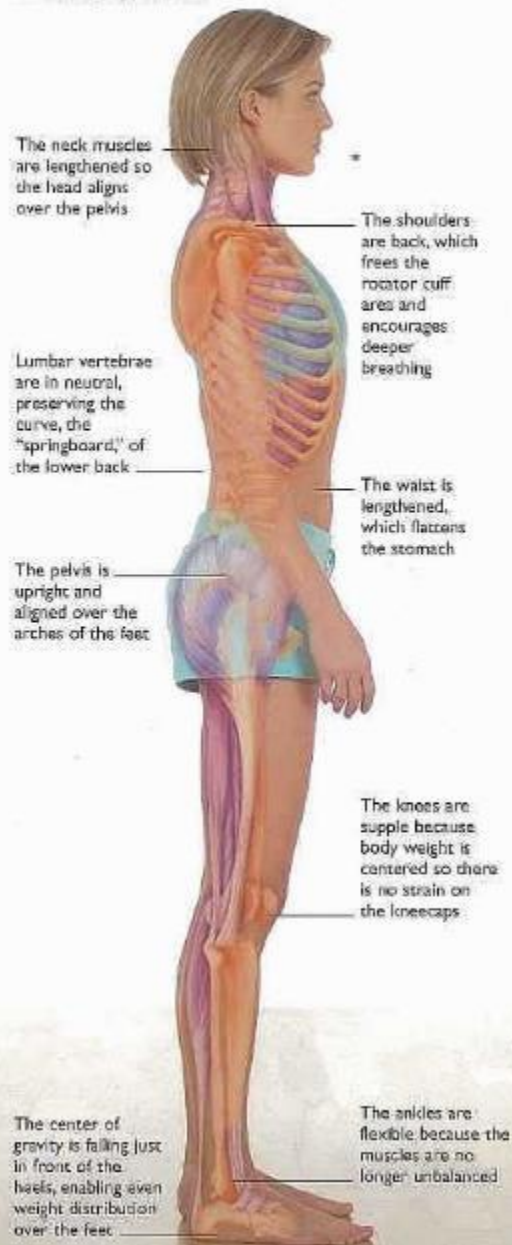
TYPICAL BAD POSTURE

Tight muscles pull the skeleton out of alignment, creating awkward and ungainly posture. Muscle aches and pains are common for this person.



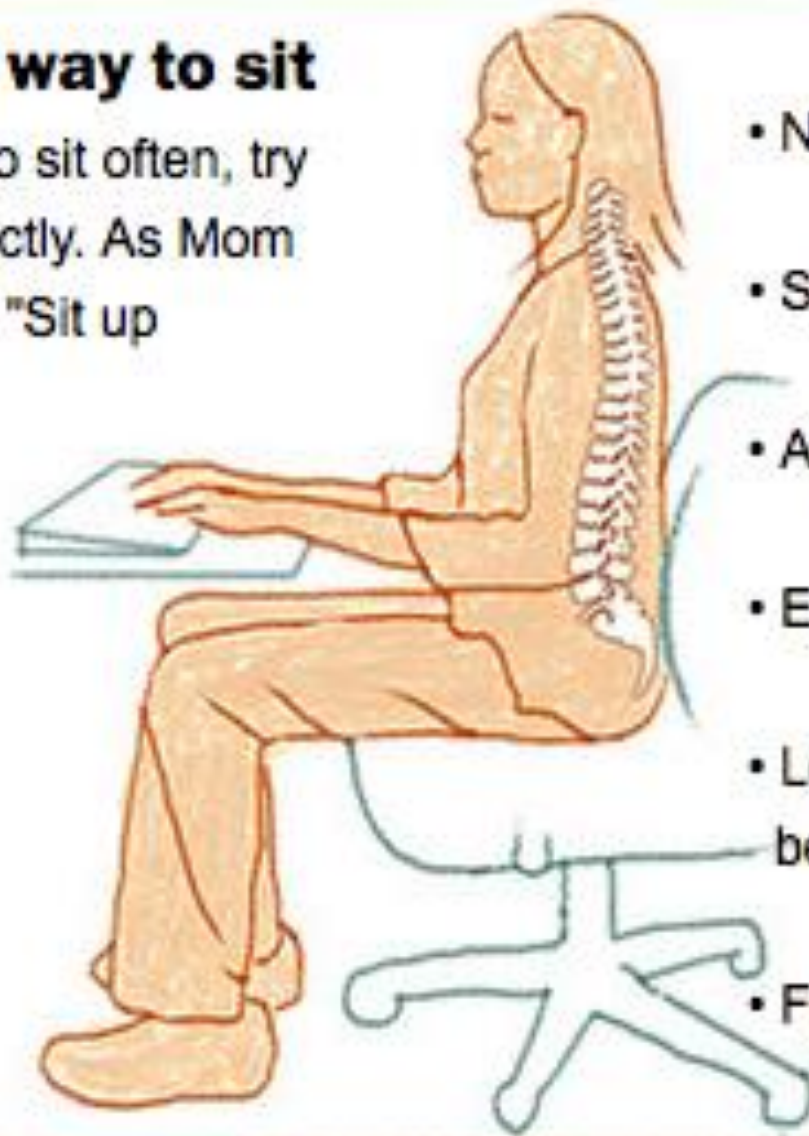
IDEAL POSTURE

The head aligns over the pelvis, the shoulders are back, and the muscles are balanced, giving a sleek, streamlined appearance.



The right way to sit

If you have to sit often, try to do it correctly. As Mom always said, "Sit up straight."



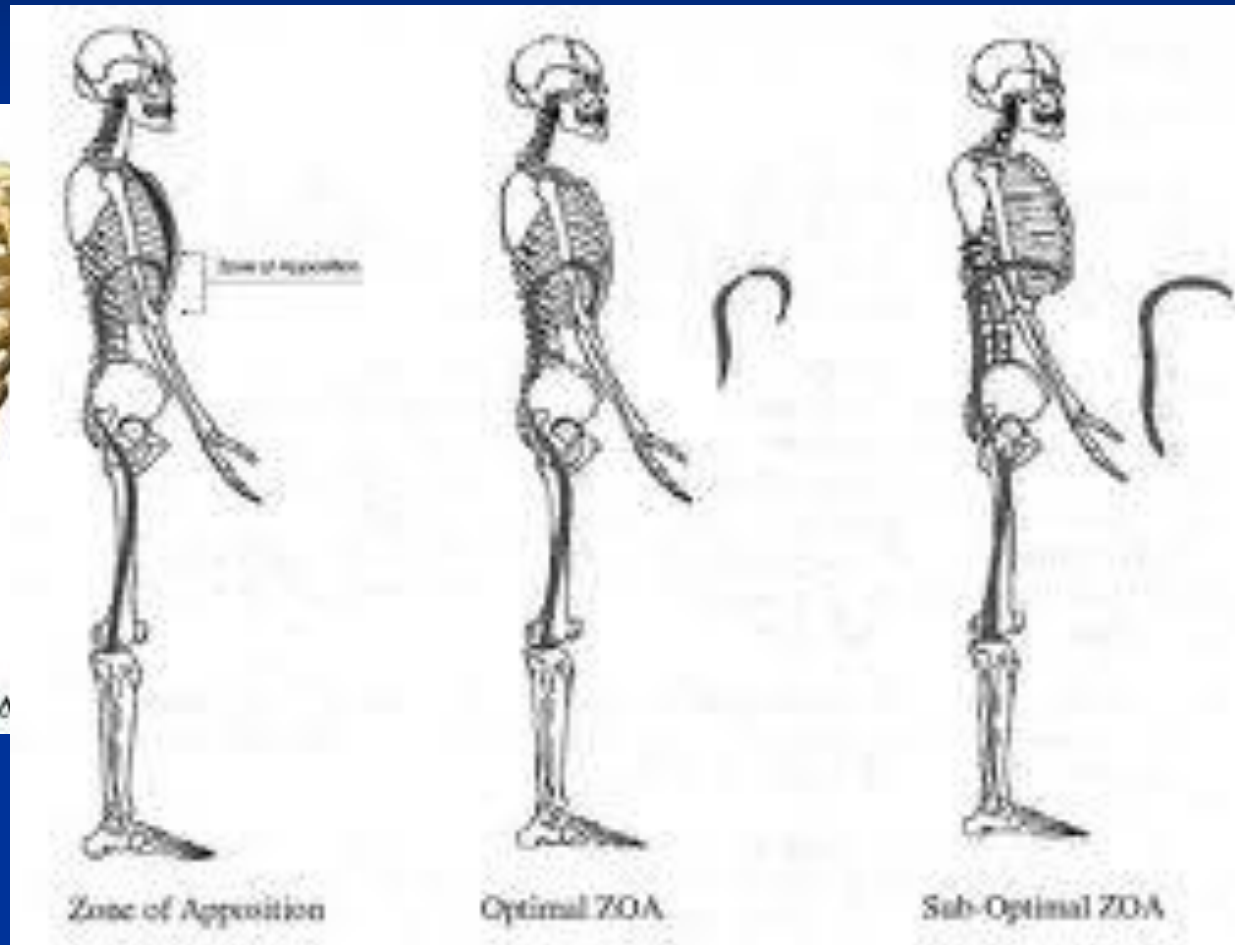
- Not leaning forward
- Shoulders relaxed
- Arms close to sides
- Elbows bent 90°
- Lower back may be supported
- Feet flat on floor

Breathing - Stability

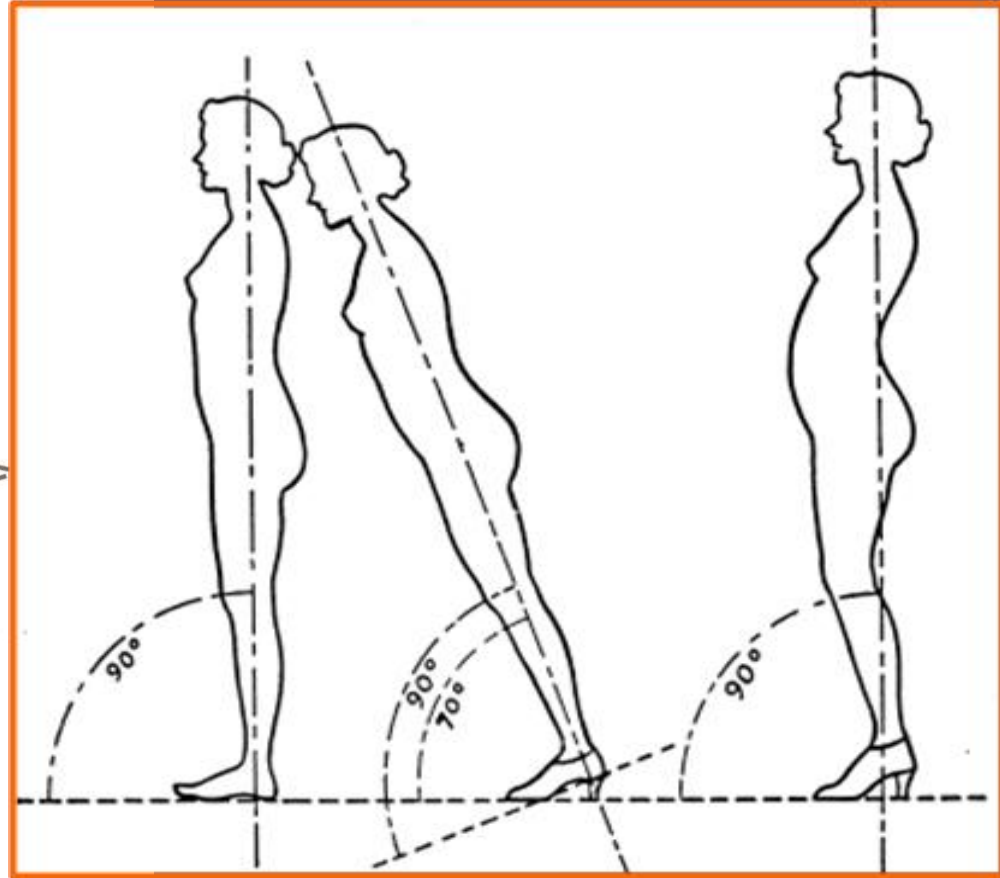
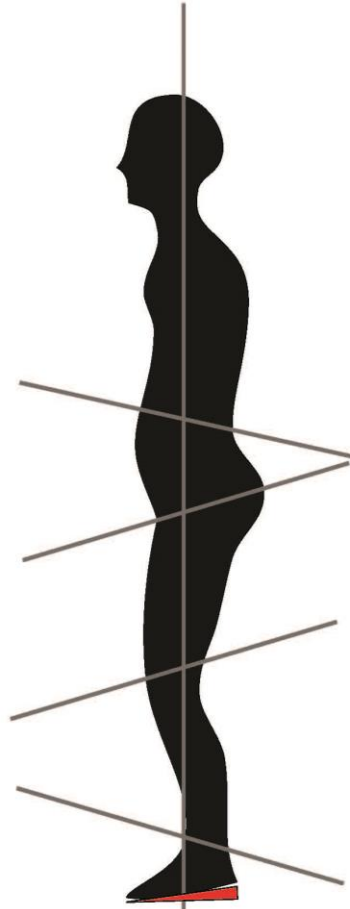
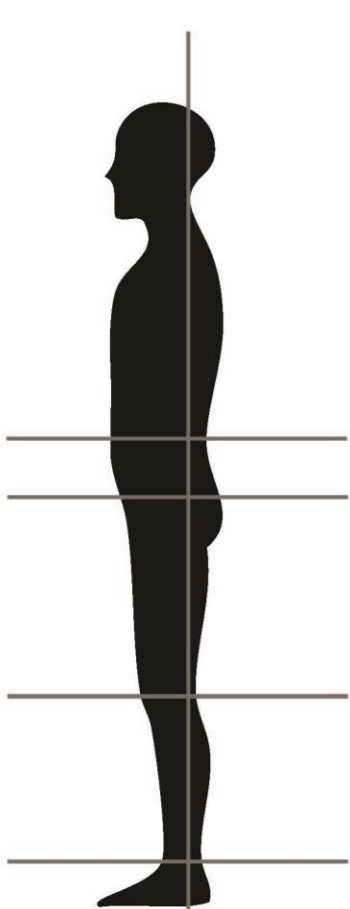
Postural Restoration Institute



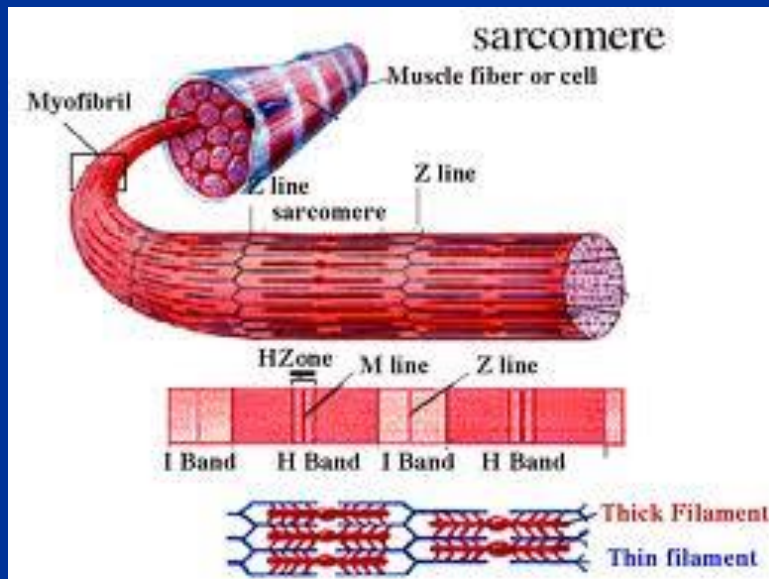
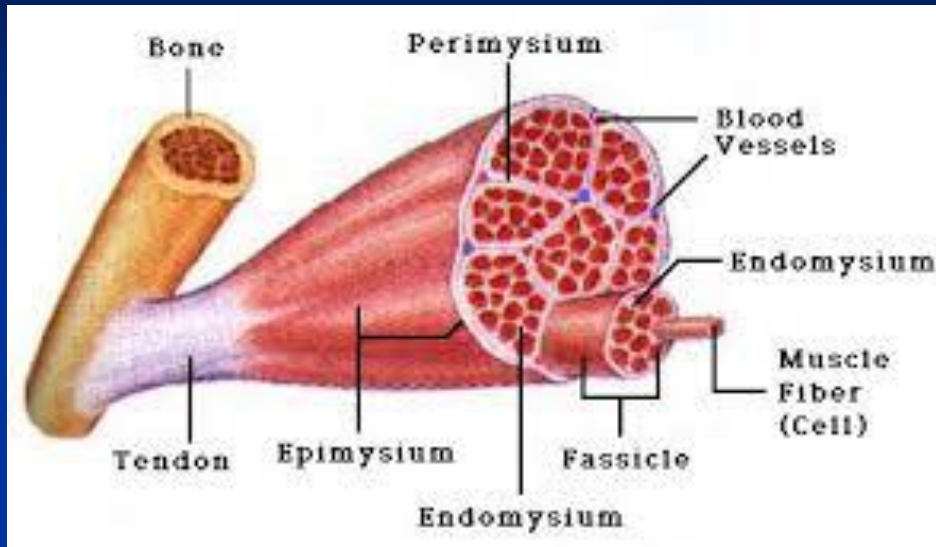
The diaphragm is shaped like a parachute



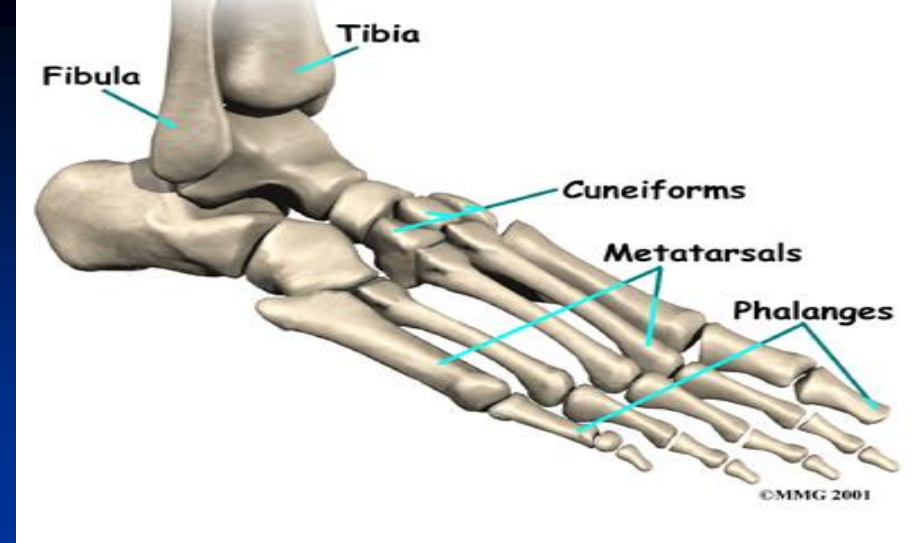
Footwear Affects Posture



Fascia vs Muscle



The Foot and Ankle



- The human body has a built-in suspension system. The main part of this system is the foot.
- The foot has 26 bones and 33 joints.
- It can bend in
129,110,040,087,761,027,839,616,029,934,664,535,539,337,183,380,513 (33³³)
different ways
- I think you want this strong, springy, and supple

Gerard Hartmann- PT to over 500 Olympians and WR Holders

It is my view that most people's feet are redundantly weak.

The deconditioned musculature of the foot is the greatest imbalance resulting in injury that I see in my practice.

Mankind by relying on footwear to control and protect the foot has allowed the foot to become weak and deconditioned.

The focus by the athletic footwear industry in the past 25 years in treating the foot as a weak link that needs to be packaged, cushioned and controlled in motion by anti-pronation devices has its limitations.

It solves one problem but it presents us with another.

**Yes You Can
Strengthen
The Foot
Even if You
Wear Shoes!**



1 Month



18 Months

The Human Spring- Wake it Up and Keep it Alive!

Shoes and Support Dampen the Spring over Time

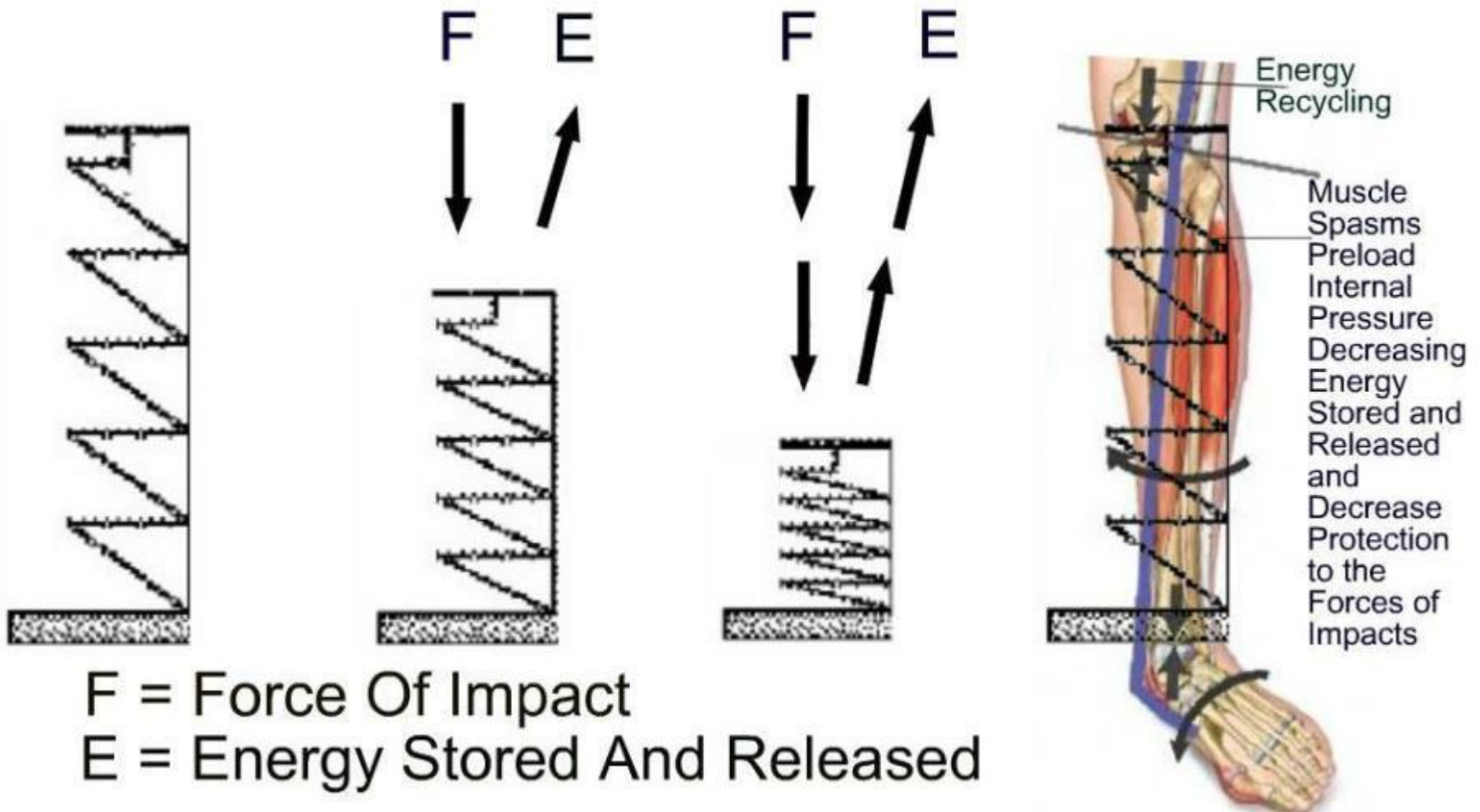




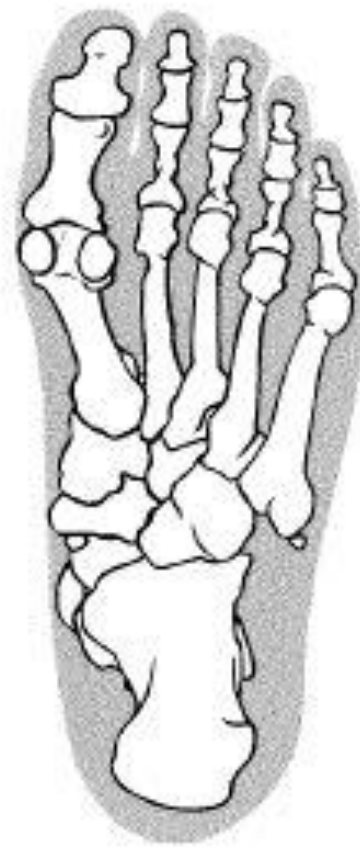
Figure 4: Perfect feet of shoeless young boys. Note straight toes and spaces between.

The Military Shoe ☹️





**NATURAL AND
STABLE**



**UNNATURAL
AND UNSTABLE**

Mobility- Hips, Ankle, Great toe, Shoulder



Stability- Foot, Posture, and Core **STEP WIDTH IMPT**



What about Strength

Can't Fire a Cannon From a Canoe



How Should We Include Strength Work

Think Prehab, Not Rehab- *We have been rehabbing the movement out of us*

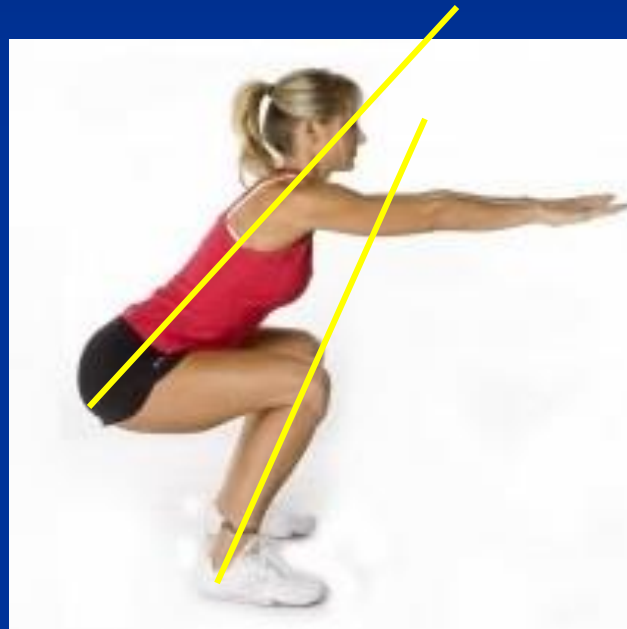
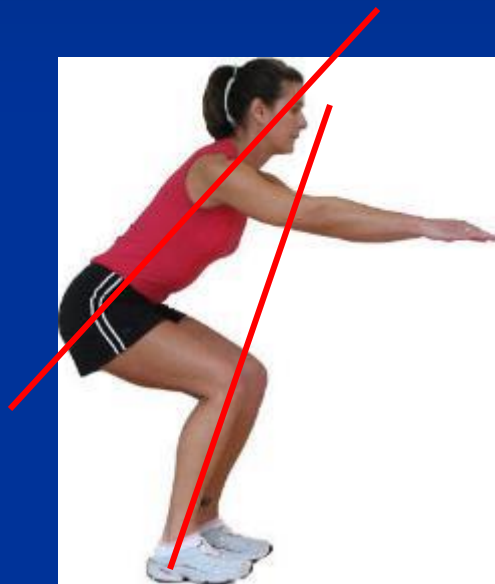
- Focus on the most effective exercises first. Strength training doesn't need to take long

My Fab 3

- Goblet Squats
- Kettle Swings
- Turkish Getup



Which Squat Does Yours Look Like?



**How Do You Mean
You Get Fast By
Running Slow?
....What About
“High Intensity”**

Jogging Reaaaaally Sloooooowww



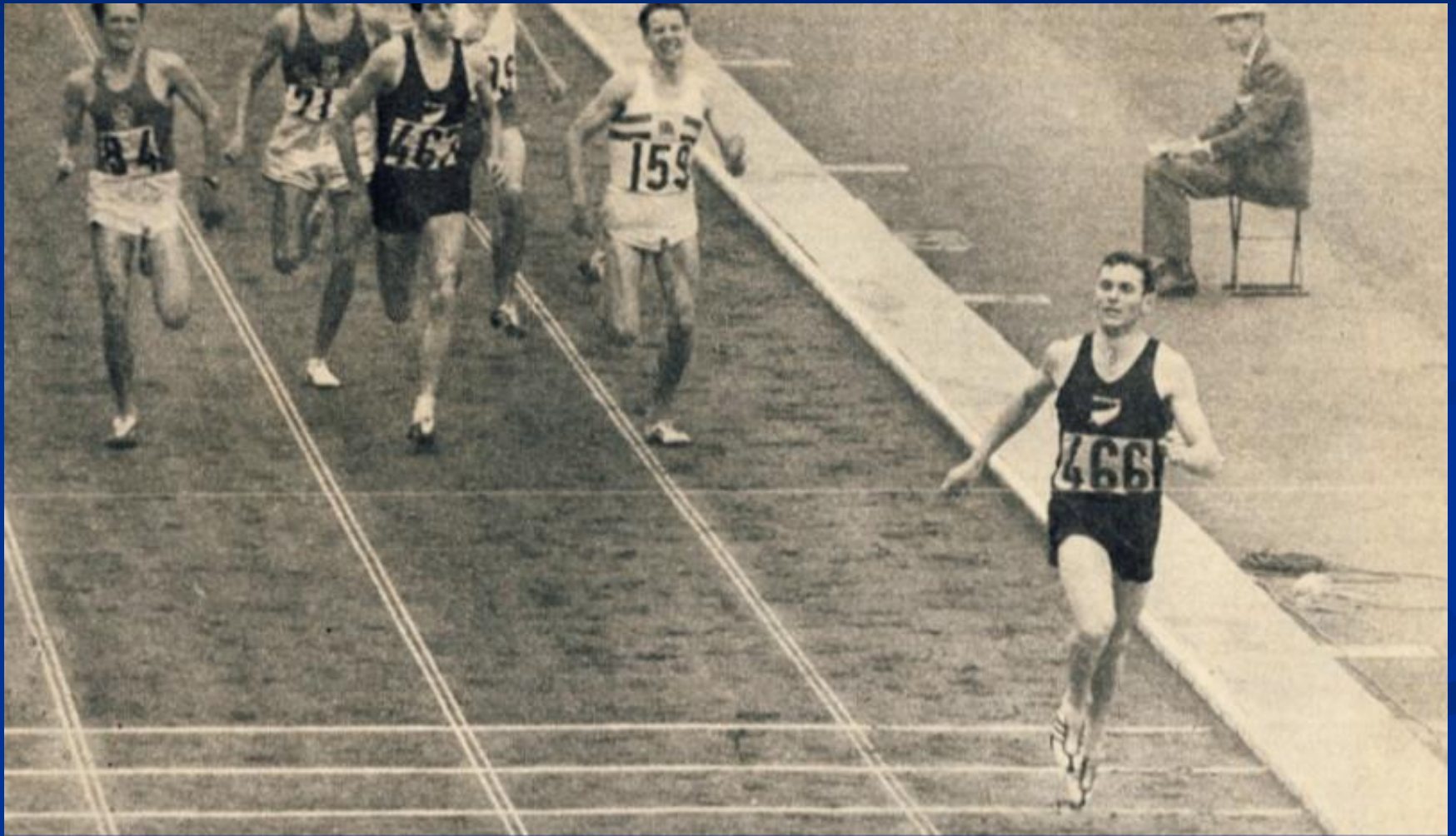
Just Keep Your Mouth Shut! Running Should be Recovery



Meet Dr. Peter Snell 3 Olympic Gold Medals



Tokyo 1964 -Gold On A Training Run



Why Slower Running Makes You Faster

Two ways to recruit fast twitch
muscle fibers

**Dedicated to the memory of my coach,
mentor and friend – Arthur L. Lydiard**

Presentation by Peter Snell, PhD
University of Texas Southwestern
Medical Center Sept. 10, 2011



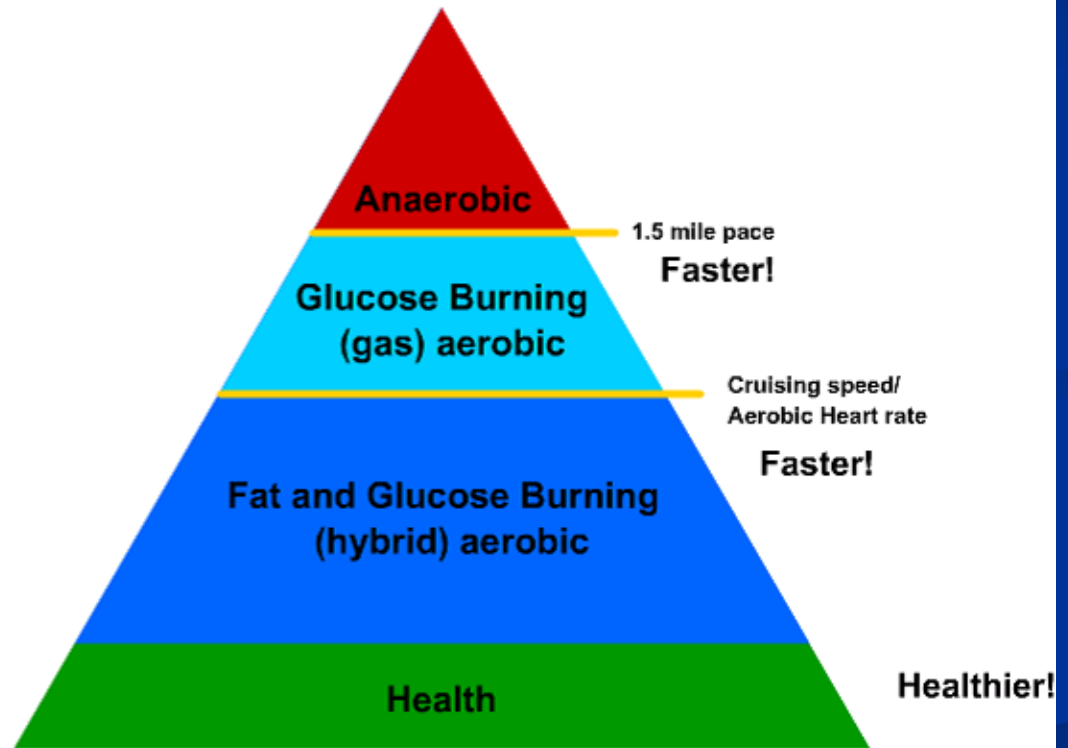
Are You PISA or GIZA? Arthur Lydiard



Giza- Endurance Trained



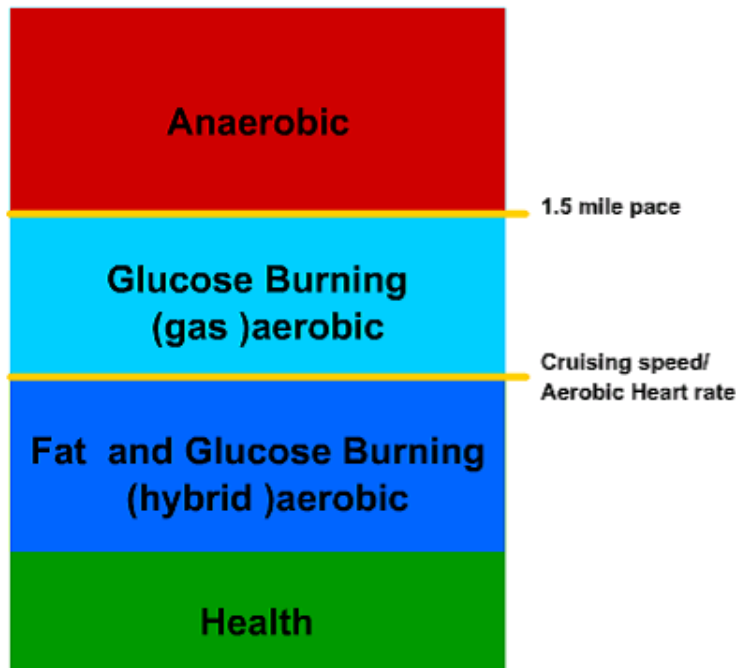
Beginning Endurance Training



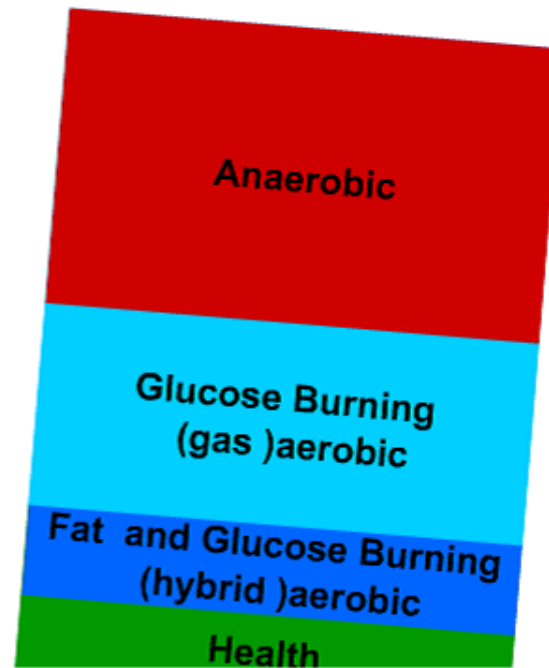
Months/Years of Endurance Training

Pisa- Without Endurance

Without Endurance and Running Too Hard



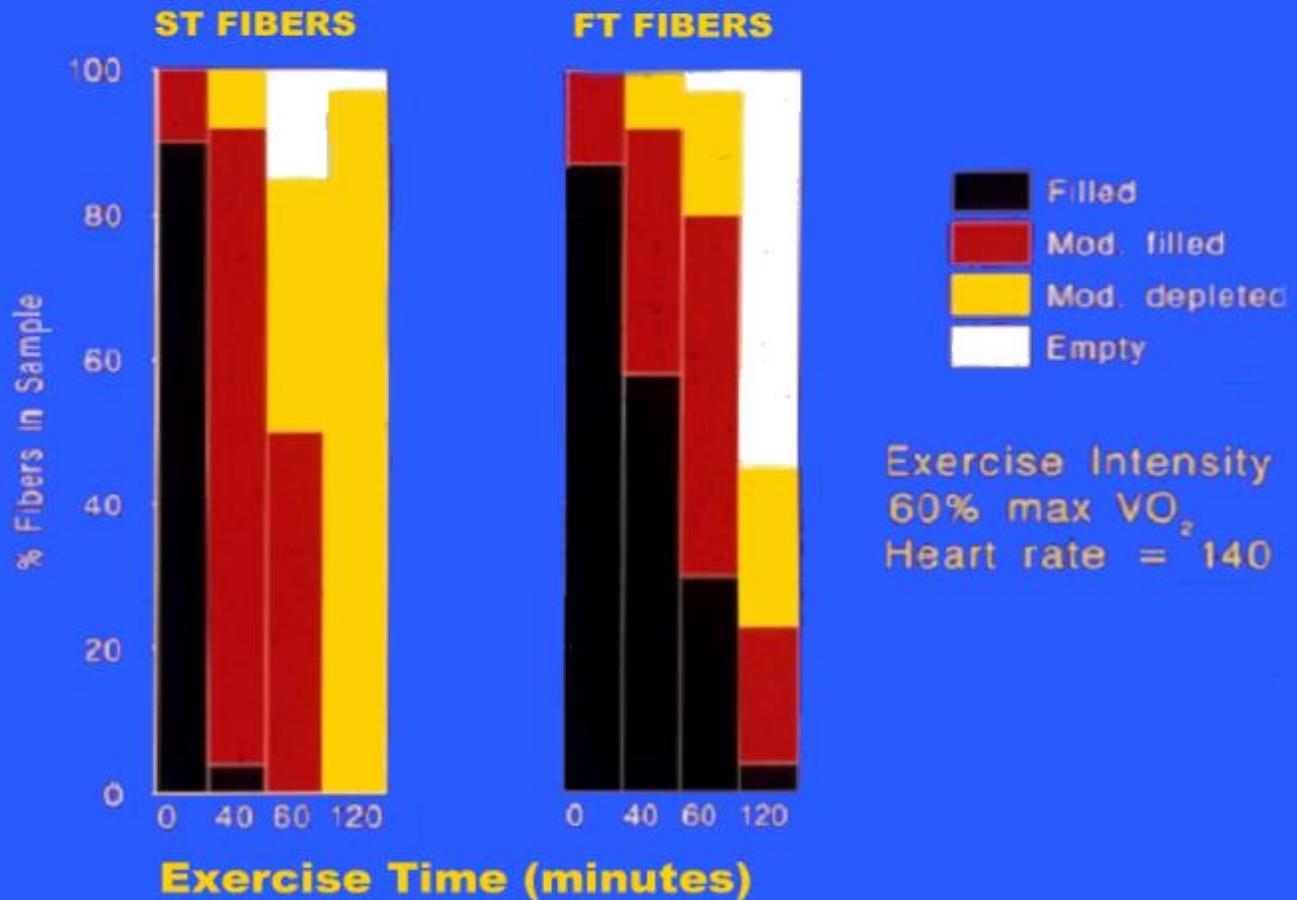
Poor Aerobic Base



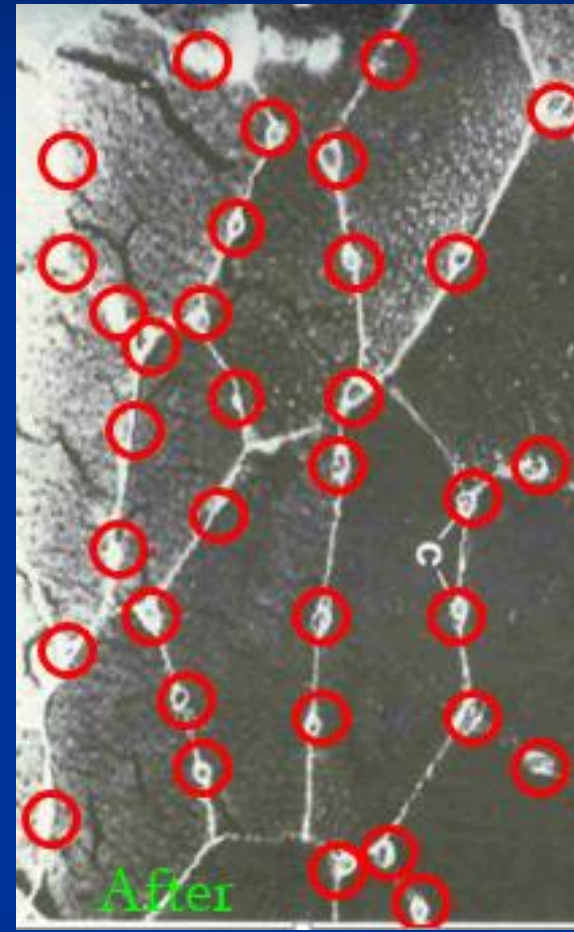
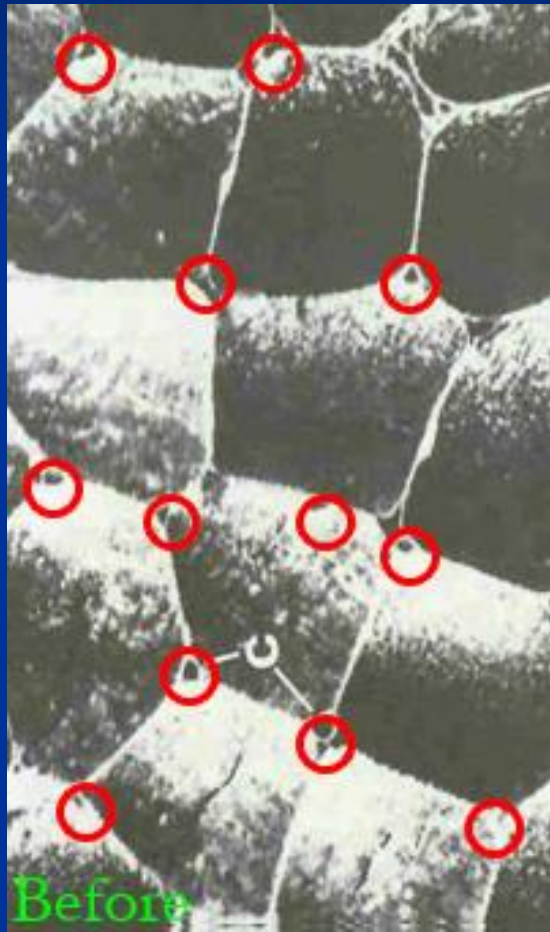
Aerobic Base Diminishes, Performance Lowers, Injuries Occur, Health Suffers

Magic Speed From a Long Slow Jog

GLYCOGEN DEPLETION IN ST & FT MUSCLE FIBERS



Capillaries Before and After

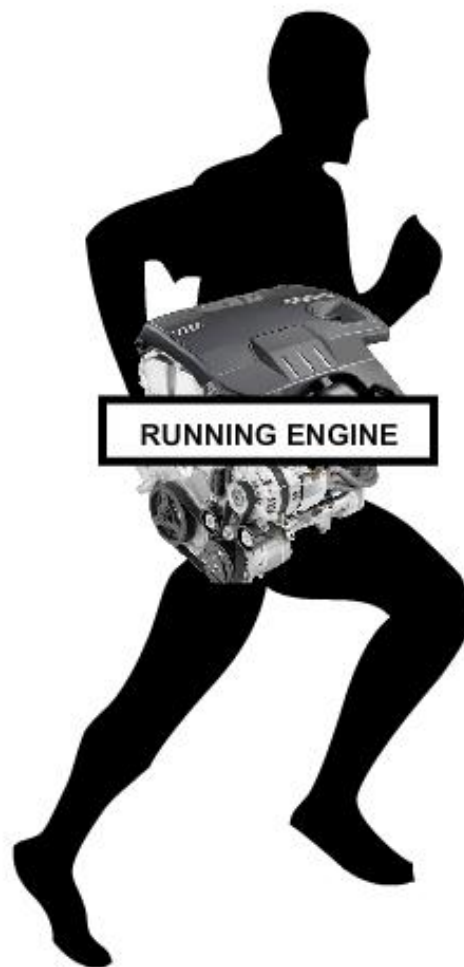


2 Fuels for the Endurance Engine

Gas



Sugar



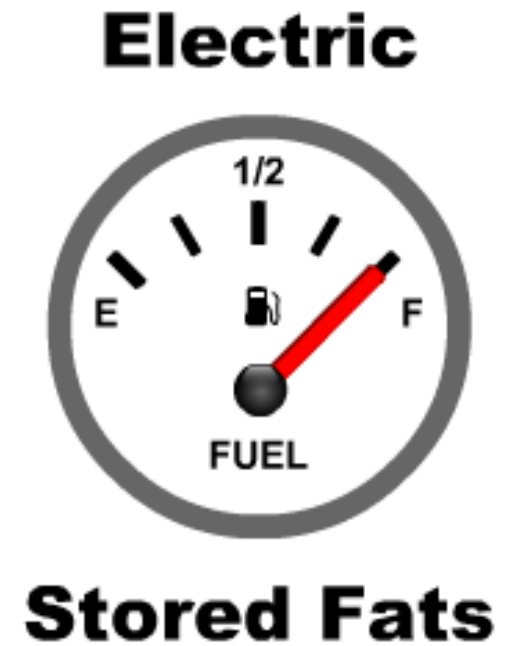
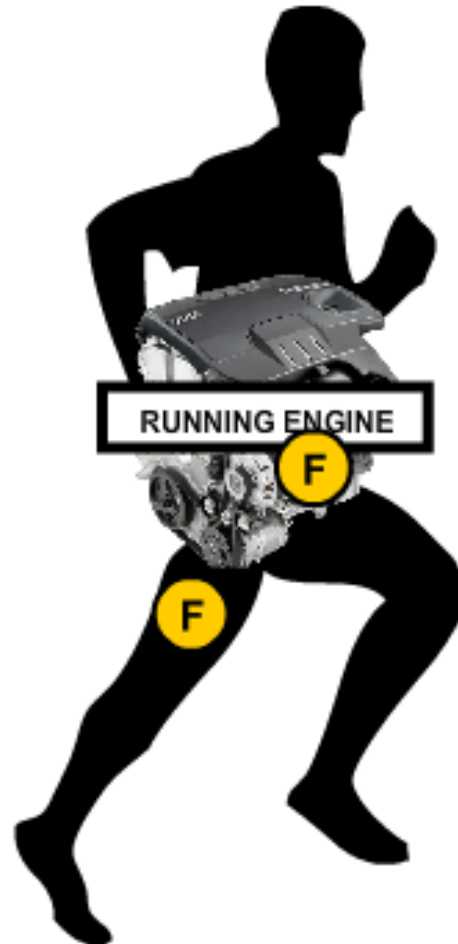
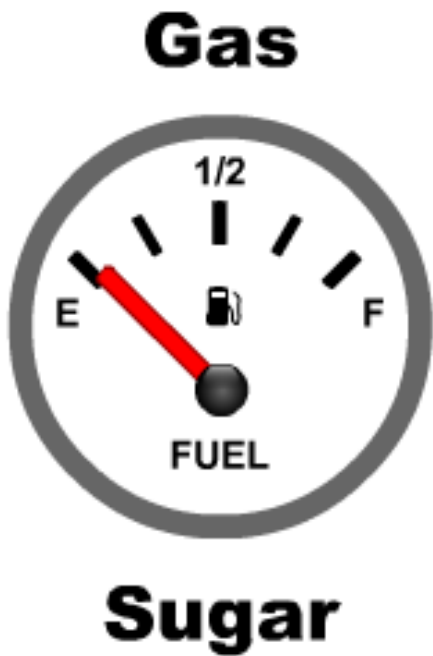
Electric



Stored Fats

Limited Sugars

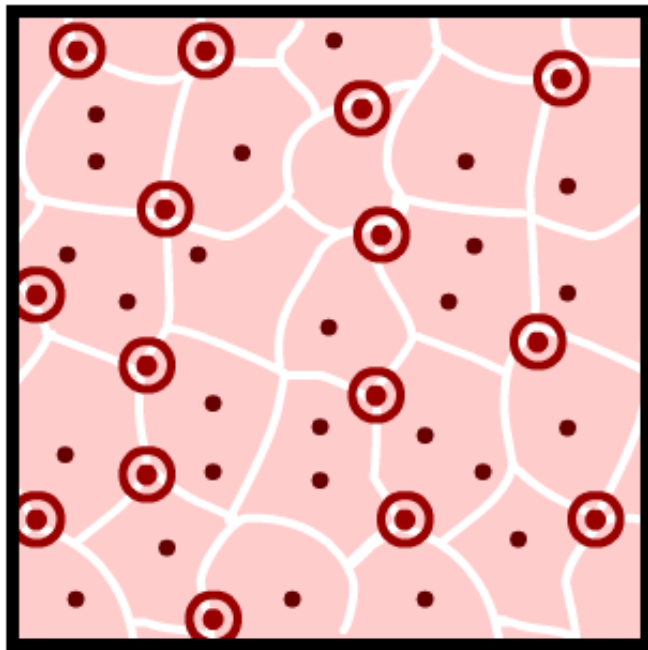
Limitless Fats



The Effect of Endurance Training

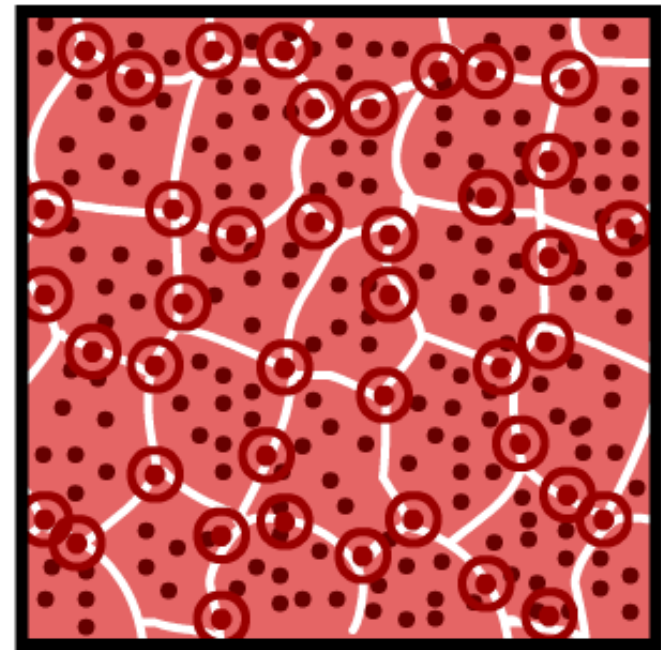
Training

Red/Aerobic muscle



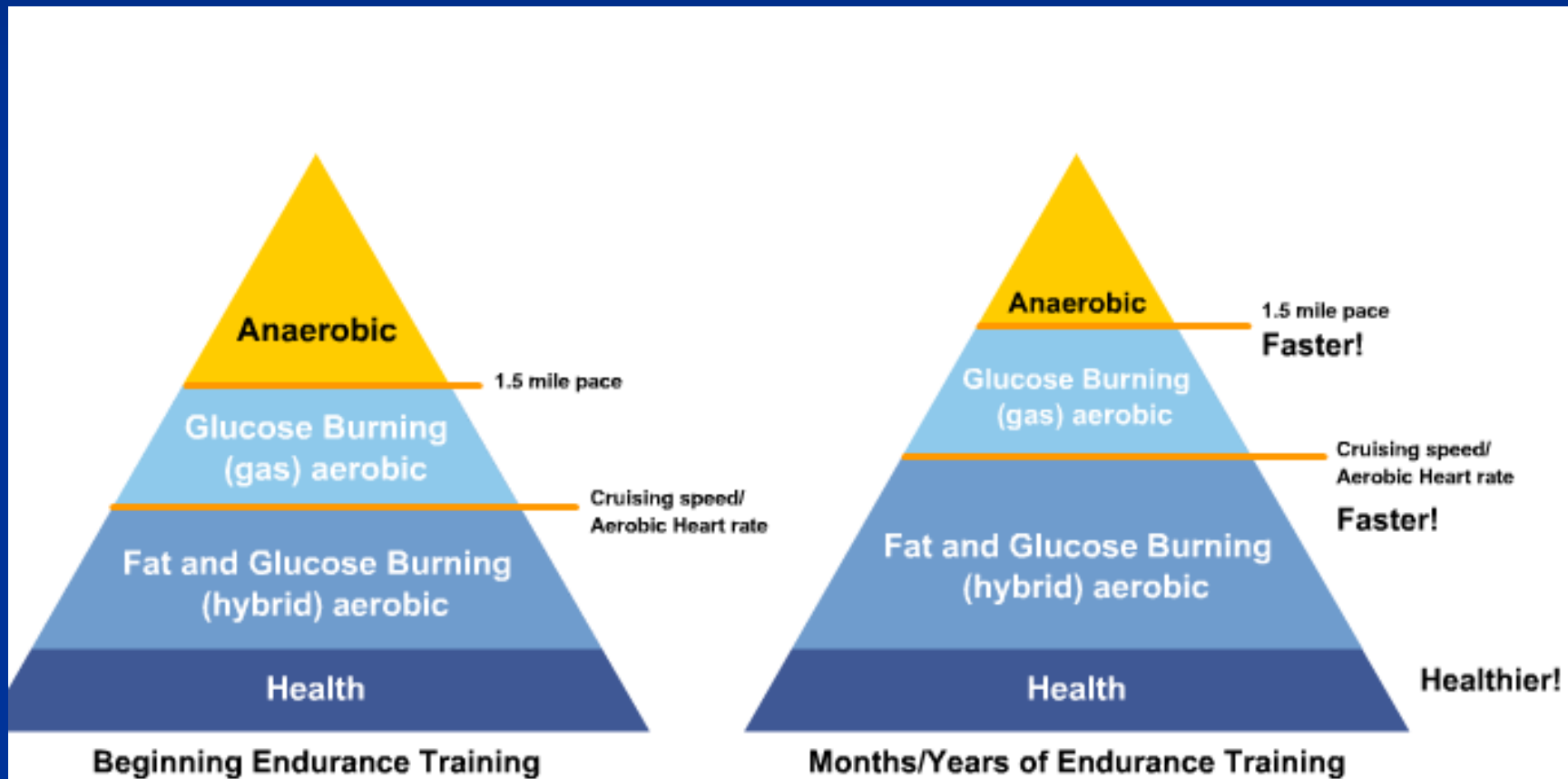
No Endurance Training

- Capillaries
- Mitochondria

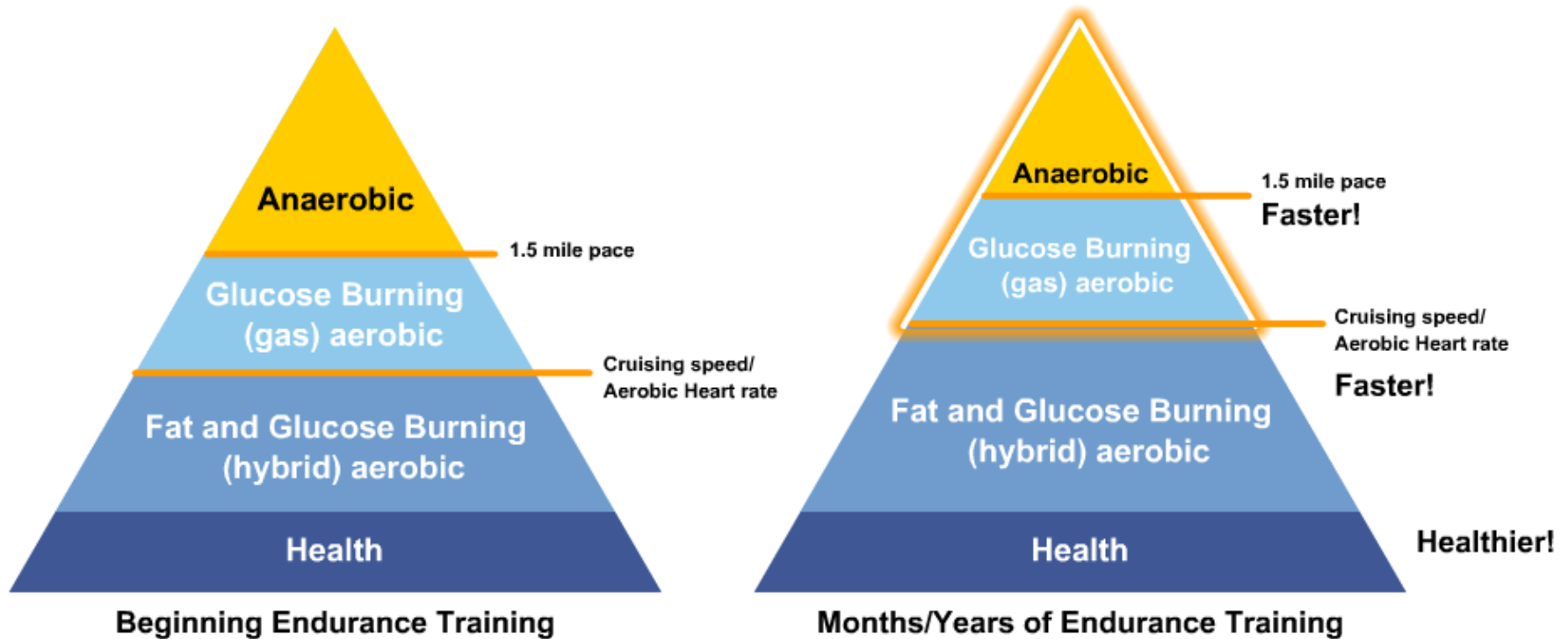


After Endurance Training

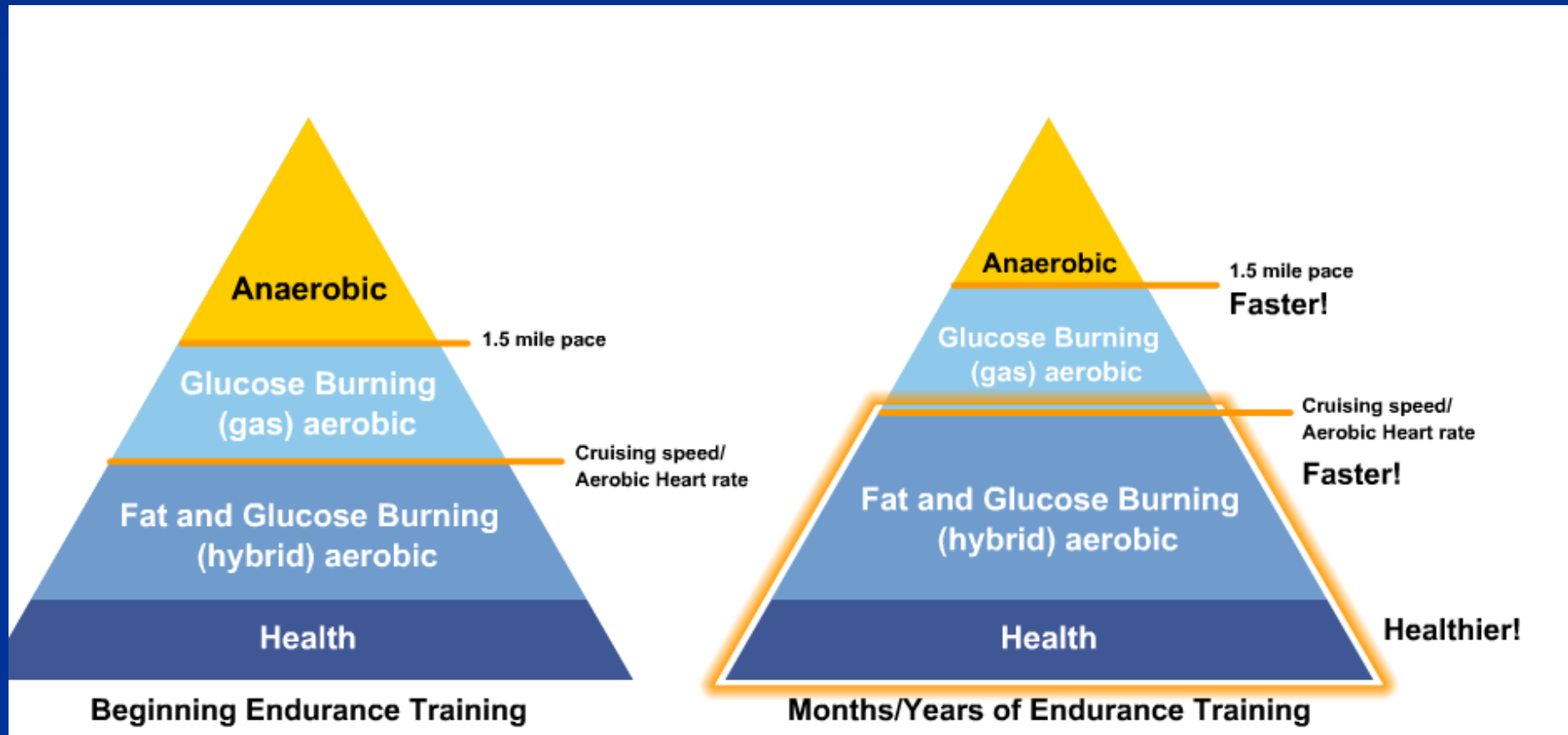
Increase Your Cruising Speed and Get Healthy



Caution if you are Training only in these Zones



Even When Adding Speed Keep Most of Running in Happy Hybrid Mode

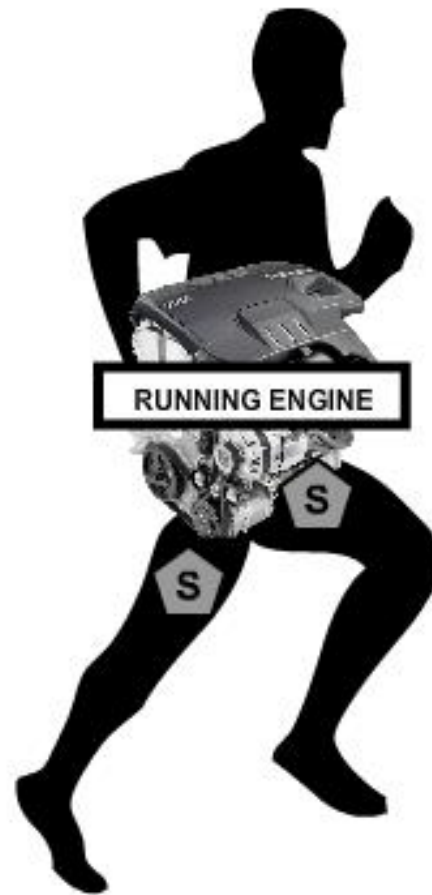


Running on Empty

Gas



Sugar

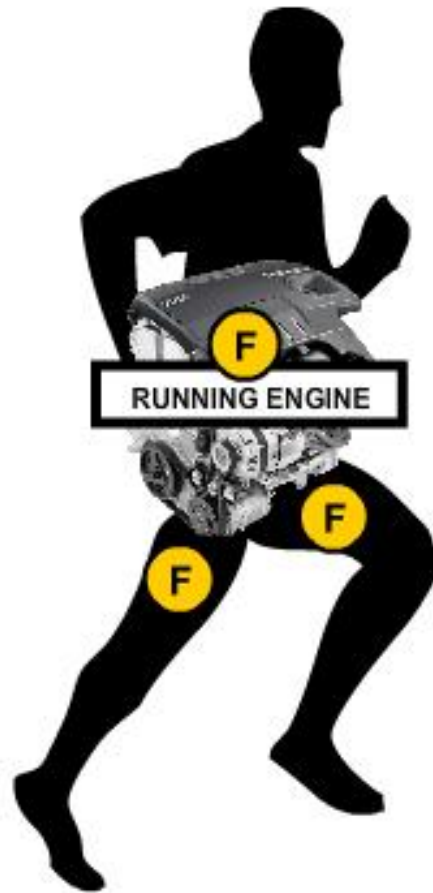


Electric



Stored Fats

The Tank that Never Empties



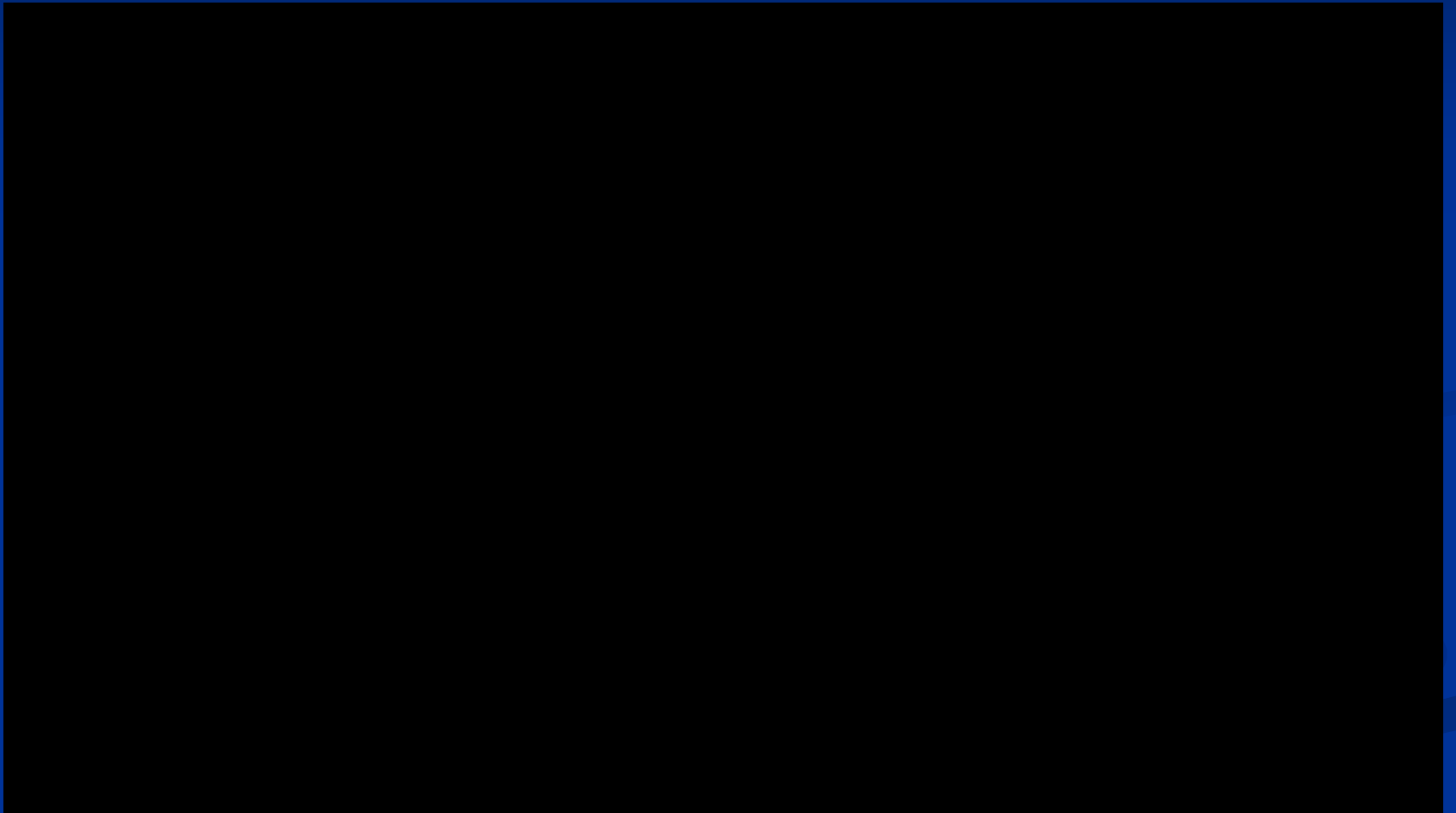
Heart Rate Training- Dr . Phil Maffetone

- MAF HR \sim 180-AGE
- Calculated MAF HR is higher 10-20 BPM
(200 BPM – Age instead of 180 BPM – Age)
- Traditional HR training zones may no longer be optimal
- HRV (Heart Rate Variability) important
- More research needed in this area

Building Endurance Through the Seasons...Maybe Years



Software- Gait Retraining



Slow Jogging- The Gait Retraining Revolution

land soft and springy and close to center
reaaaalllly slow- slower than a walk



Dover AFB Slow Jogging



Yokota Warrior Run Program 9 weeks over 2 min off run time & 2 inches off WC



- Fun, strength, aerobic, nutrition, form, progress, improve overall health



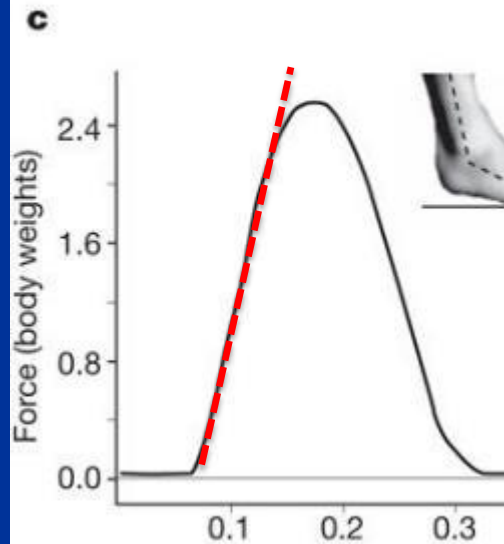
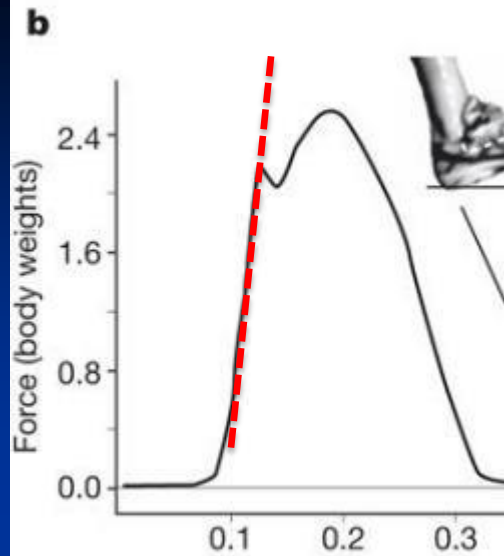
Lily Gait Lab



Loading Rate

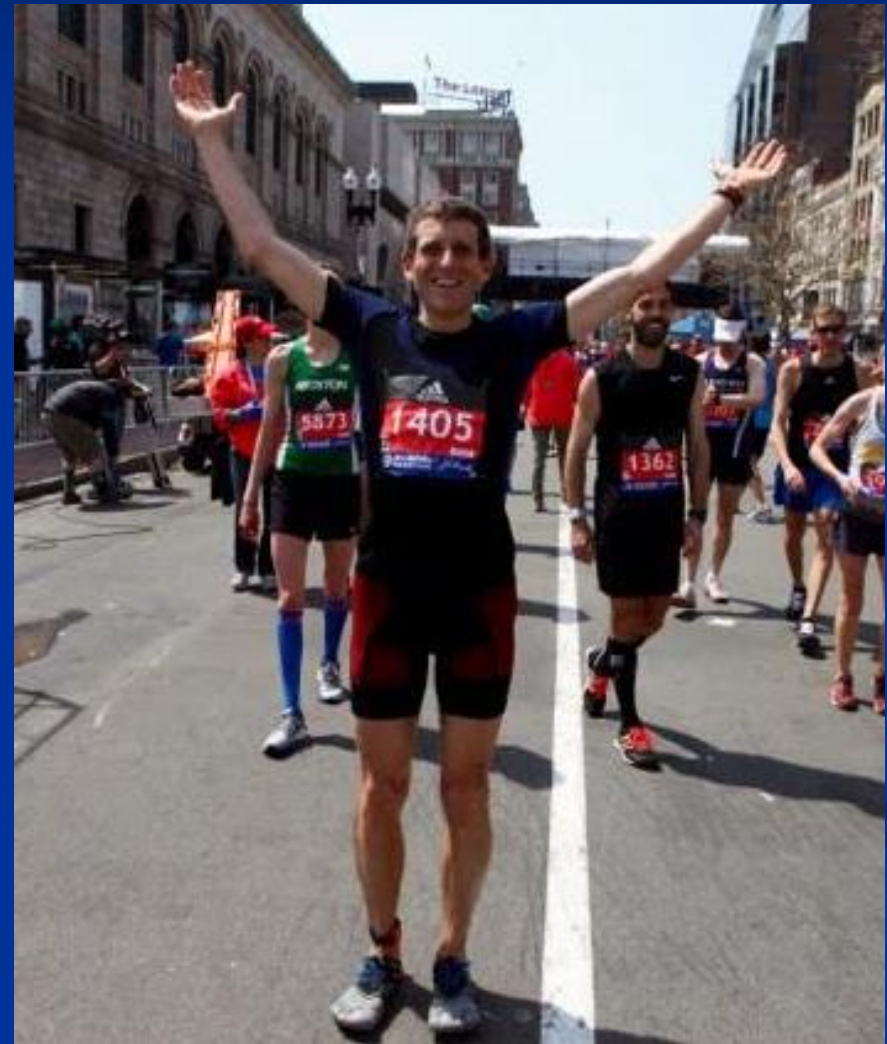
How quickly the force reaches maximum value

Reductions in loading rate through form training are far greater than the use of shoes, foot orthotics, or shock reducing insoles.



Boston 2016

Irene Davis trial on loading rates



Lieberman Skeletal Lab



Recovery day for me but not for the dogs



Reframing Recovery

- Not faster recovery, less damage
- Improved Hormonal Balance
- Endogenous Glycogen Synthesis
- Improved Hormetic response

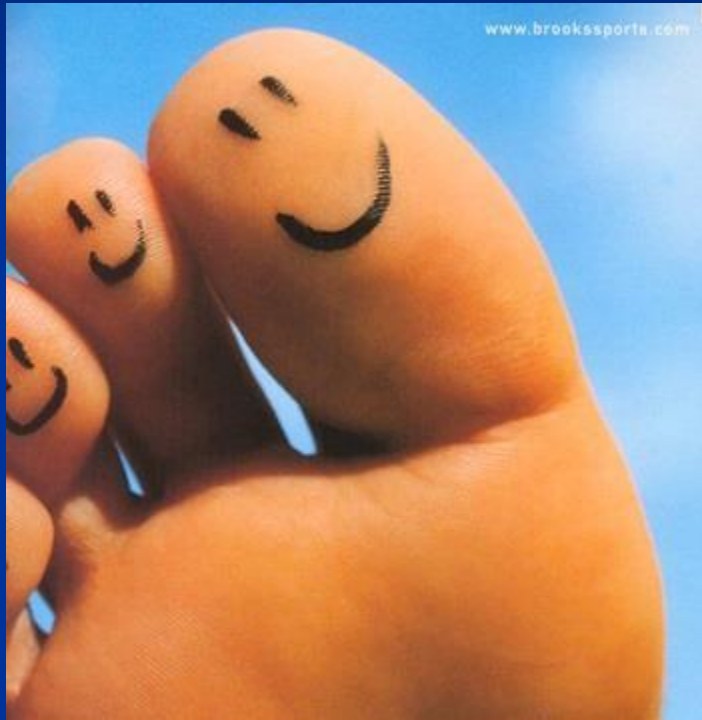
Experience of Peter Defty and Low Carb Athletes

“What you notice is what you don’t notice”

- The Ups & Downs in energy levels
- Mental Fog
- Bonking, cravings
- Mental Focus & Motor Skills
- Lower perceived effort
- Recovery

Experience of Peter Defty and Low Carb Athletes

Smile!



The Bare Essentials- Simplicity Will Set You Free



Cook!



Take Care of Yourself First Wake Up....Do I Love Myself?



- Luke Skywalker: “I don’t believe it!”
- Yoda: “That is why you fail.”



The Hero's Journey

Thank you and “Imagine”



barefoot run
in Central Park

Running Makes us Human

Isaac Coltrin and The National Anthem

Final 100 meters Championship Race



Thanks to YOU Who Have Helped Me (US) Learn

- Prof Noakes
- Dr Phil Maffetone
- Dr Stephen Phinney
- Dr Jeff Volek
- Nina Teicholz
- Dr Dan Lieberman
- Peter Defty of Vespa
- Gary Taubes
- Dr Jason Fung
- Dr Jeff Gerber
- Jimmy Moore
- Dr Eric Westman
- All of my courageous patients!



Yesterday Boreas Pass

www.drmarksdesk.com
www.naturalrunningcenter.com

Run with a Smile

afrundoc@gmail.com