# THE SCIENCE OF SPRINTING FOR NON-SCIENTIST

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## A LITTLE BIT MORE ABOUT ME…

- I have not been out of the CIF Interscholastic loop since coming to American River College in 2005. I have had the pleasure of working with some of the finest sprinters, hurdlers, and horizontal jumpers in the San Joaquin Section.
- With the permission of the athletic directors, head coaches, and parents, I have been blessed to have coached the most dominating duo of high school girl horizontal jumpers in our area the past five seasons.
- Kendal Nielsen (Bear River HS 2012 – Currently attending Cal Poly SLO) The best complete Horizontal Jumper I have ever coached. Highly proficient in the Triple Jump, Long Jump as well as the short sprints. Multiple SMOC championships, Division III San Joaquin Championships in the Horizontal Jumps. Stanford Invitational Top 3 Finish and 2 time CIF State Meet participant in both the Long and Triple Jump reaching the finals and podium in 2012.

- Meghan Tacker (Placer HS 2014 – UCLA freshman)
- Two time SMOC champion in the Long Jump. Stanford Invitational Champion in the Long Jump 2014, Two Time Division III Champion in the Long Jump, Two-time CIF Interscholastic Championship qualifier and podium medal in 2014 in the Long Jump.
- Most consistent of any Long Jumper I have ever coached in terms of her ability to be on the board and her ability to not allow the size of the meet to interfere with her focus. She has the most impressive series I have ever witnessed at a high level competition (2013 SMOC Long Jump final.
- What do these two young ladies have in common?
- We spent time together (consistency)
- I addressed their need in order to evolve (sprint speed/sprint mechanics)
- THEY TRUST ME!

- Coaching influences…
  - John Harvey (De La Salle, HS)
  - Curtis Taylor (Univ of Oregon)
  - Kebba Tolbert (Harvard)
  - Tony Veney (USATF Clinician-HC Ventura College)
  - Kevin Tyler (Univ of Oklahoma)
  - Vince Anderson (Texas A&M)
  - Ronnye Harrison (Portland State Univ)
  - Douglas Oyang (City College of San Francisco)
  - Matt Kane (Univ of Alabama)
  - Ken Harden (Florida State Univ)

## INTRODUCTION

- This presentation is meant to provide you the coach with the means in which to create, implement, adjust, and fine-tune your training methods in terms of the Sprint Races (60m – 400m).
- Once you have the basic tools in which to begin your sprint training program, you will then be able to enhance your program with continued education from USATF Level I & Level II curriculum.
- The one piece of advice I can offer you is that you never stop seeking knowledge. That you never think you know enough, and that you always have an open mind to embrace things that you may not understand right away. In this way it will allow you to evolve and grow in the perfection of your own training theory.

- It is my endeavor to help all in attendance to understand the level of importance required regarding your training methods and philosophy and it's direct impact on your athlete's ability to perform.
- In doing so I plan to challenge some of your thinking processes, {as mine where and still are} in regards to why you do what you do. The question is whether or not you are successful. You may have a genetic freak of nature, you may have the luxury to recruit from a broad talent base and literally have the "pick of the litter." This in itself does not validate your philosophy as being sound…it could mean you are lucky.
- If you have a team of 60+ athletes and only a handful are showing improvement…then I would have to ask a question of you? What happened to the other 85% of your team?

- With that being asked…he comes my retort to your answer… "Where is the science to back up your answer?"
- Hence today we will provide you with some basic science by somewhat simplifying its definition so that you may more readily grasp concepts that have been tried, tested, and proven by some of the greatest coaches in the world, in some of the fastest (but not technically advanced nations in the world.)

## DESCRIBE YOUR BACKGROUND AND TRAINING PHILOSOPHY

- This is not a trick question. This is merely a way for use to begin beneficial dialog on the reason we may or may not be experiencing the optimal effects of the science of sprinting…
- What is your philosophy and what is it based upon (foundation)?
- Did you compete?
- What were/are your events?
- What events do you coach?
- What is the basis of that philosophy –
- Science, Technical, Knowledge based, Historical data, or baseless…

## VOCABULARY

- Acceleration – concerned with the change in velocity per unit of time.
- Adaptation – persistent changes in structure of function particularity related to response to increments of training load.
- ATP-PC System – an anaerobic energy in which ATP is manufactured when phosphocreatine (PC) is broken down.
- Biological Age – the physical maturity of an athlete.
- Biomechanics – the science concerned with the internal and external forces acting on a human body and the effects produced by these forces; mechanics as applied to human movement.
  - An understanding of Biomechanics is important to success in coaching because it provides rationale and reason for the techniques we teach.

## THERE IS NOTHING IN NATURE WHICH IS FAST THAT TRAINS FAST

- In nature, the fastest animals on the planet have an inherent propensity for acceleration. Once they are born and able to maintain balance, they are beginning the lessons of acceleration.
- Why? Because in nature – it is a means of SURVIVAL! Be it on land or under the sea…most predators are fast… Case in point
- Did you know that you cannot outrun a bear?
- Did you know that you cannot outrun a Lion, Tiger, Cheetah, Hyena,
- You cannot outswim a Shark, Orca, or Dolphins

Now lets look at man-made or man-trained nature objects…

- In preparation for driving race cars well over 120mph for long periods of time, does the drive practice at 60mph then wait a month before the big race to practice max acceleration and control?
- When a jockey is training a thoroughbred for the Triple Crown, is he or she trotting around the track until a week or two before the race and then decide to crank up the intensity?
- In order for airplanes to take off, can they cruise down the runway and simply obtain altitude?
- Here is a nice concise answer for you – NO!

## WHY?

- Jumpers – Jump
- Throwers – Throw
- Distance runners – run long distance
- So why do you train your sprinters "backwards?"
- Why do you not train your sprinters in the sprint realm more?
- In the world of High School – You share athletes. You need to be able to assess two key areas in your training:
- What kind of shape are they in (if they come from another sport)
- How much time is available until major competitions and what are the event critical success factors

## BE A DESERT – NOT AN OCEAN…

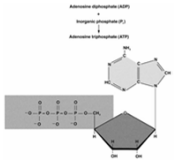
SEEK KNOWLEDGE LIKE THE DESERTS SEEKS MOISTURE…REIDISM 2014

- If you desire to be successful you must obtain and use the knowledge at your disposal to:
- The sport sciences – physiology, biomechanics, kinesiology, nutrition,
- Technical skills incorporation/development/enhancement
- Tactical components of the event.

Determining the energy systems demands for your particular event lays the foundation for the annual training plan

## ATP
### THE SOURCE OF MUSCULAR ENERGY

- **Adenosine Triphosphate - ATP, is the immediate usable form of chemical energy for muscular activity.**
  - **Depleted in 1 - 2 seconds unless recharged to maintain muscular activity.**
- **Adenosine ---- P - P - P = ATP**



## ATP - THE SOURCE OF MUSCULAR ENERGY

- Adenosine ---- P - P (ENERGY) Pi
  - ATP Breakdown
- Energy from foods and phosphocreatine
  - ADP + Pi ---------> ATP
- ATP synthesis by coupling reactions

## ENERGY SYSTEMS
**The three systems of metabolic pathways available to replace ATP concentrations are:**

1. **Anaerobic Phosphagen (ATP-CP) Energy System**
2. **Anaerobic Lactate (Glycolytic) Energy System**
3. **Aerobic Energy System**

## ANAEROBIC (ATP-CP) ENERGY SYSTEM

- **Energy rich compound called Creatine Phosphate (CP) is present in muscle.**
  - **Depleted usually 10 to 30 seconds.**
- **Points that must be followed in the training sessions:**
  - **The speed component of anaerobic metabolism.**
  - **Weight training, sets of around 3-4 repetitions.**
  - **Most athletes require 24-36 hours of rest.**

## ANAEROBIC (ATP-CP) ENERGY SYSTEM

- **Speed component is trained when fatigue is not present**
- **Recovery rates for CP resynthesis.**
  - **30 seconds - 50%**
  - **1 minute - 75%**
  - **90 seconds - 80%**
  - **3 minutes - 98%**
- **Four (4) sets, involving 4 X 4 X 45m (i.e., 720 meters) in total distance in a practice session is sufficient to stimulate this system.**

## ANAEROBIC (ATP-CP) SPEED WORK

**INTENSITY**
- **95-100% of maximal heart rate**

**DISTANCE OF RUN**
- **20-60 meters**

**NUMBER OF REPS/SET**
- **3-4**

**NUMBER OF SETS**
- **3-4 (5)**

**TOTAL DISTANCE IN SET**
- **80-120 meters**

**TOTAL DISTANCE IN SESSION**
- **400-600 meters**

## SAMPLE OF ANAEROBIC (ATP-CP) SPEED WORK

- **SPRINTS**
  - **A.5 X 30 B. 4 X 30 C. 4 X 40**
    **4 X 40 4 X 40 4 X 50**
    **4 X 50 4 X 60**
    **310 meters 480 meters 600 meters**
- **HURDLING A. 5 X 50 B. 5 x 50**
  **5 x 35 5 x 70**
  **425 meters 600 meters**
- **SPEED RESISTANCE WT. TRAINING**
  **4-6 REPS/SET**
  **3-5 SETS**
  **4-6 SECOND DURATION/SET**
  - **2-3 minute rest between sets**

## TYPES OF ANAEROBIC LACTATE (GLYCOLYTIC) EXERCISE

- **Speed Endurance: 95-100% for approximately 8 to 20 seconds (60-150 meters).**
- **Special Endurance I: 90 to 100% for approximately 20 to 40 seconds (150-300 meters)**
- **Special Endurance II: 90 to 100% intensity for approximately 40 seconds to 2 minutes, 300-600 meters**

## AEROBIC ENERGY SYSTEM

- **CONTINUOUS TEMPO (General Endurance): Easy runs using the continuous method, at about 60% of maximal heart rate.**
- **EXTENSIVE TEMPO: 70-80% (HR 140-160) intensity, involves relaxed and smooth running at 60-80% intensity.**
- **INTENSIVE TEMPO: 80-90% intensity, a relaxed, smooth and controlled tempo exercise**
- **If I am a sprinter…why would I need this to be a part of my training cycle?????**

## TECHNICAL TRAINING

- Determine what you can influence
- Determine what you 'need to do'
- Set up the plan

## WHAT CAN YOU INFLUENCE?

- Technique
- Training
- Communication

## TEACHING PROGRESSIONS

- Drills and technical exercises are training activities designed to provide opportunity to teach certain fundamental skills.
- It is important to note that these provide an environment in which to teach, they do not teach.

## CUES AND CUEING SYSTEMS

- Cues are words we use to elicit responses in our athletes.
- Cue systems are combinations of cues we use in order to elicit various responses or levels of a response.

## OBSERVATION

- Attention to ground contacts
- Attention to postures
- Attention to learning influences
  - Temporal
    - Athlete learns via use of rhythms
  - Spatial
    - Athlete cues into positions, postures, and movement patterns
    - Athletes need to feel what we know

## PURPOSE

- Biomechanics is the study of human movement.
- An understanding of Biomechanics is important to success in coaching because it provides rationale and reason for the techniques we teach.

## COMPATIBLE TRAINING MODELS

- 1. Endurance runs (general strength, specific) with strength endurance exercises that help to develop general strength endurance.
- 2. Speed development runs with speed strength development exercises (jumping and bounding complexes – but do the strength development exercises first).
- 3. Speed development runs and exercises with explosive dynamic strength development exercises (short jumps).
- 4. Speed development runs with movement coordination development runs with movement coordination development exercises (starts, finishing drills, specific sprinting drills).

## NON-COMPATIBLE

- 1. Speed development with any type of endurance runs over 80m distances.
- 2. Speed development with strength endurance development exercises.
- 3. Speed development with strength development with strength development exercises (maximal strength method).
- 4. Strength development (maximal strength method) with any type of endurance runs.
- 5. Exercise complexes for the development of coordination with strength development exercises (maximal strength method)

## ADAPTATION

- The Principle of Adaptation states that the body will adapt to any stresses placed upon it in a manner that will enable it to better handle subsequent stress of the same type.

## ADAPTATION

- The adaptation process exhibits the following two characteristics.
  - 1. The Principle of Specificity states that adaptation is specific to the stress or stimulus placed upon the body.
    - The body will adapt in a manner that enables it to better cope with similar stress in the future, but the ability to deal with differing stresses remains unchanged or may diminish.

## TRAINING THEORY PRINCIPLES

- The Principle of Reversibility
  - If the training stimulus falls below that which the body is accustomed, a negative adaptation occurs and fitness is lost.
- The Principle of Rest and Recovery Inclusion
  - Rest and recovery opportunity is necessary to the adaptive process, and must be included in the training program in a planned fashion.
  - Inclusion of rest and recovery should not be left to chance. Know how to rest certain body systems while training others so that time spent in non-training status is minimized.
  - In its simplest form, all training design is balancing overload, rest and recovery.

- The training format must include the following ingredients in order to address bio-motor capabilities:
  - Stimulus
  - Adaptation response
  - Stabilization
  - Actualization
- Patience is a virtue!
  - You must allow time for the stabilization effect to take place after adaptation:
  - Sprinting/Acceleration skills must be repeated in order to obtain a higher level of proficiency at which time other components can be added such as speed/special endurance components.

## TRAINING PARAMETERS

- Volume
  - The total amount of training done in a time period
- Intensity
  - The difficulty or degree of demand of training
- Density
  - Related to volume it is the frequency of training stimulus in the program
- Complexity
  - The degree of coordinative demand a training activity places on the body. Complexity is related to intensity in that it is a component of intensity

## INDIVIDUALIZATION IN TRAINING

- Individualization of Training is necessary, as no particular level of training stimulus is effective for all athletes.
  - Each athlete needs a certain level of training stress sufficient to foster adaptation, yet not so excessive as to hinder adaptation and invite injury.
  - Training of lower intensity is safe for groups, but training of higher intensity must be individualized.
  - Individualization may take many forms, such as varying distances run, numbers of sets, numbers of repetitions, amount of weight lifted, altering hurdle or box height, or exercise choice.

## REFERENCES