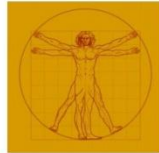

SPORTFIT LAB



SCIENTIFIC TRAINING

The Science of Triathlon

Testing and Training
Physiology

History of Triathlon

1974 – First known swim/bike/run events held – for fun and cross-training purposes – at Mission Bay in San Diego by members of the San Diego Track Club.

1978 – John Collins, a U.S. Naval Officer, takes the swim/bike/run concept to Hawaii, combining three previous endurance events (Waikiki Rough Water Swim, Around-Oahu Bike Ride, and Honolulu Marathon) into one giant race – the Ironman. Twelve men competed in that first race.

1979 – Only 13 men and one woman cross the Ironman finish line, but a Sports Illustrated article about the event brings much publicity.

1980 – The Ironman field grows to several hundred and ABC Sports comes to Hawaii to cover the event.

1982 – In the last year no qualifying is required to enter the Ironman, Julie Moss collapses and crawls across the finish line in second place. The dramatic footage triggers an explosion of interest in the event. That same year, the U.S. Triathlon Ass'n. (now USA Triathlon), the U.S. Triathlon Series, and Triathlon Magazine are all born.

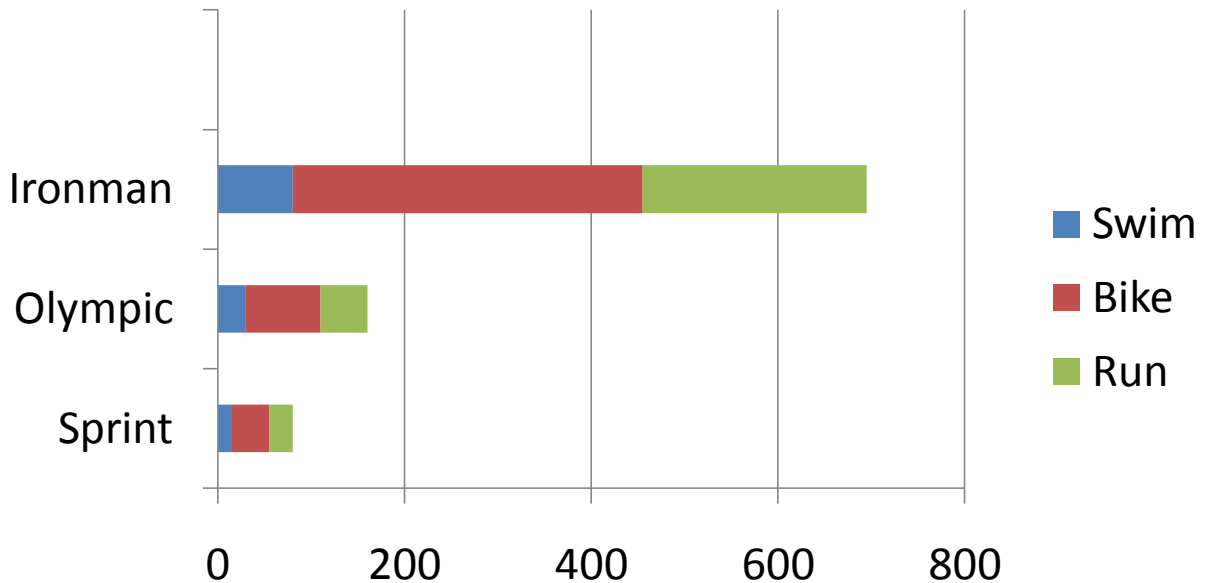
1989 – An international governing body, ITU, is formed, with 25 nations represented. One goal is to gain Olympic admission, and the Olympic-distance triathlon (1.5km swim, 40km bike, and 10km run) is set as the official qualifying distance. This is now the most popular triathlon racing distance.

2000 – Triathlon enters the Olympic Games as a medal event for both men and women.

NOW – OVER 2,000 TRIATHLON EVENTS OF VARYING DISTANCES TAKE PLACE EACH YEAR IN THE U.S. AND USAT HAS 125,000 ATHLETE-MEMBERS. Many new triathletes compete in “sprint” distance events, which are officially one-half the Olympic distance – but often vary based on individual race requirements.



Triathlon Competition



- No single event determines triathlon finish
- Swim: “you can’t win the race on the swim, but you can lose it.”
- Bike: the longest portion – large performance gains can be made.
- Run: also very important.

Triathlon Physiology

What determines performance in triathlon?

1. Energy production to produce speed
2. Endurance to maintain energy production
3. Efficiency/technique in each discipline

Energy Production Processes in Muscles

Three energy-producing systems in the muscles:

1. Aerobic – low energy, high efficiency system using oxygen to burn energy
 - a) Can be sustained for long periods (hours)
 - b) Minimal waste products are easily recycled
 - c) Predominant energy system used in endurance events
2. Anaerobic – high energy system for greater speeds and muscle demands
 - a) Works concurrently with the aerobic system in longer events
 - b) Increases as energy demands increase
 - c) Waste products (pyruvate, lactate) not as easily recycled
 - d) Predominant in events lasting 30 sec. to 4 minutes;
3. Phosphocreatine (PC) – very high energy bursts of 5-30 seconds (no O₂)
 - a) All-out sprints or climbs
 - b) Can only be sustained for a few seconds at a time

Oxygen Systems in the Body

1. Pulmonary (lungs) – how much oxygen can you breathe in and absorb?
2. Cardiovascular – how much oxygen can be pumped by your heart and transported to the muscles?
3. Muscular – how much oxygen can be used by the muscles themselves?

WE WANT TO DETERMINE WHICH SYSTEM IS LIMITING YOUR PERFORMANCE!

Muscle Fiber Types

All muscles contain two basic categories of muscle fibers:

1. Slow-twitch – oxidative fibers high in mitochondria (which produce aerobic energy)
 - a) Can work for long periods (hours) before fatiguing
 - b) Used for consistent, slow/moderate energy production
2. Fast-twitch – high energy fibers used more for anaerobic energy
 - a) Used when energy demands are high or sudden
 - b) Fatigue relatively quickly (minutes)

Measuring Triathlon Performance Potential

PERFORMANCE CAN ONLY BE MEASURED IN RACES!

**IN THE LAB, WE MEASURE PERFORMANCE POTENTIAL
AND TRAINING STATUS**

VO₂max – The maximum amount of oxygen which can be processed by your body's muscles, usually expressed per minute and per kg of body weight:

| VO ₂ max (ml/kg/min) | | | | | |
|---------------------------------|-----------|---------|---------|----------------|-------------|
| 15 | 25 | 35 | 45 | 55 | 65 |
| Poor | Untrained | Healthy | Trained | Highly Trained | World-class |

- VO₂max is increased with training (aerobic and anaerobic)
- VO₂max is somewhat limited by genetic potential
- VO₂max correlates pretty well with aerobic endurance, but not very well with performance within elite groups.

Testing done on cycle or treadmill using Fitmate Pro

fitmate[®] PRO



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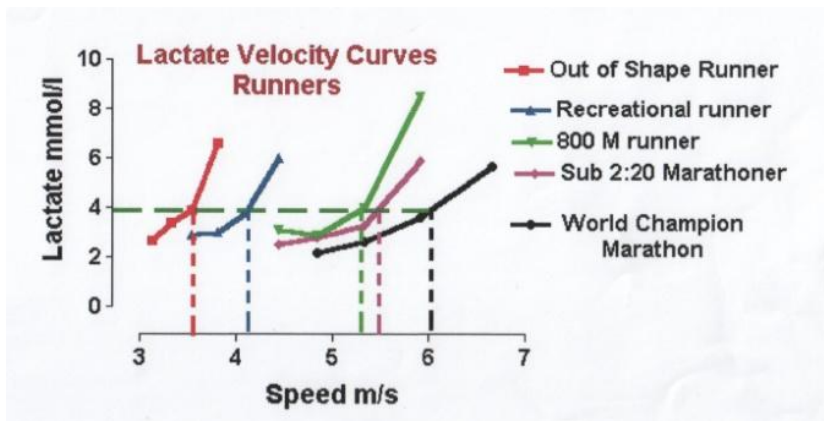


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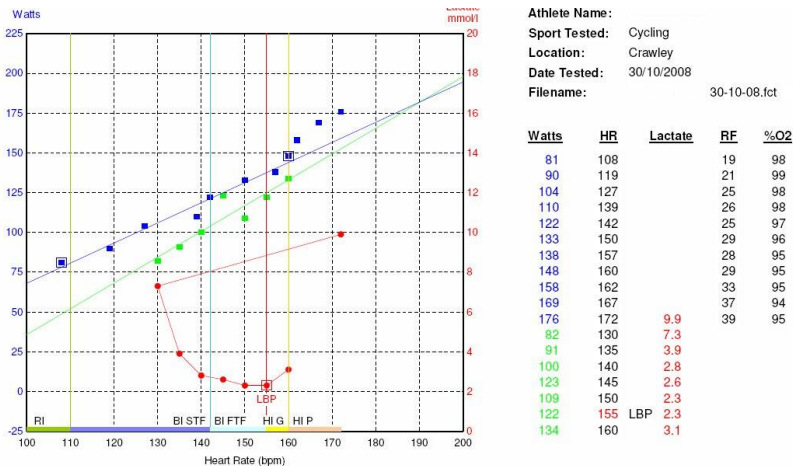
Measuring Triathlon Performance Potential

Lactate (aka lactic acid) – is produced as a by-product of anaerobic energy production, but is also recycled for energy by muscles, liver, and heart. When production exceeds recycling, lactate builds up in the muscles and bloodstream. We measure lactate buildup to determine your ability to train/race without overloading the muscles with lactate.

Lactate “Threshold” – traditionally used to estimate the level at which your body suddenly produces higher levels of lactate.



Lactate Balance Point (LBP) – new measurement method developed by FaCT-Canada to more accurately determine individual training levels. Is defined as the precise point at which your body can no longer recycle as much lactate as it is producing.

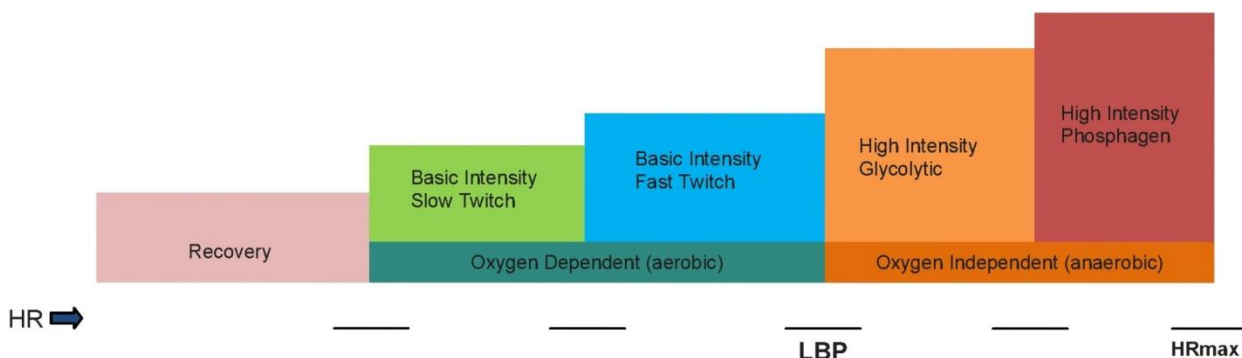


Training for Triathlon

Physiological testing gives us accurate training zones:

Training Zones

Training zones are used to elicit the proper training effect during each workout. When LBP testing is combined with VO₂ testing, training zones can be accurately based on your body's biomarkers. [Other systems simply use averages based on age or fitness level]. We calculate training zones based on heart rates because they are simple to use and will account for daily variations (fatigue, health, etc.). However, we can also calculate power or speed-based training zones if that is your preferred training method (please ask).



| Training Zone | Training Goals | Training Modes | What You Feel |
|-----------------------------|--|---|--|
| Recovery | <ul style="list-style-type: none"> Warm up before exercise Recovery or rehabilitation | <ul style="list-style-type: none"> Warm up at slow speed Recover from intense exercise | <ul style="list-style-type: none"> Core temperature rises Easy to speak |
| Basic Intensity Slow Twitch | <ul style="list-style-type: none"> Structural efficiency (+ mitochondria) Burn fat as energy source Improve aerobic endurance | <ul style="list-style-type: none"> Long, slow, distance workouts Off-season aerobic "base" training | <ul style="list-style-type: none"> Comfortable pace/breathing You can speak No muscle "burn"/fatigue |
| Basic Intensity Fast Twitch | <ul style="list-style-type: none"> Burn more calories faster Raise LBP and race pace Build muscle endurance | <ul style="list-style-type: none"> Steady-pace workouts 30-90 mins. Intervals of 3-10 mins. each Cadence work | <ul style="list-style-type: none"> Mild muscle burn/fatigue Hard to speak Heavier breathing |
| High Intensity Glycolytic | <ul style="list-style-type: none"> Increase lactate tolerance Raise LBP and pace at LBP Improve cardiac output | <ul style="list-style-type: none"> Intervals of 30 sec. to 3 mins. each Tempo workouts 20-60 mins. Time trials | <ul style="list-style-type: none"> Uncomfortable & hard Muscle burn/fatigue Can't speak/heavy breathing |
| High Intensity Phosphagen | <ul style="list-style-type: none"> Increase speed or power Increase VO₂max Tolerate hills or sprints | <ul style="list-style-type: none"> Intervals of 10 sec. to 1 min. each Sprints or intense hills/grades | <ul style="list-style-type: none"> Very uncomfortable Out of breath & want to stop |

- ***SOME TRAINING MUST BE DONE IN ALL ZONES***
- ***TRAINING WILL VARY WITH YOUR LIMITING SYSTEM***
- ***TRAINING WILL VARY WITH TIME OF YEAR AND GOALS***

Avoiding Triathlon Injuries

Most triathlon injuries are chronic overuse injuries:

- Tendinitis
- Stress fractures
- Back pain
- Joint injuries or arthritis

Avoiding chronic injuries:

- Train consistently, but don't overtrain
 - Never increase distance or speed dramatically
- Rest when your body is overtrained
- Maintain proper hydration in training and racing
- Use good nutrition to train and recover
- Have your biomechanics checked – imbalances and asymmetries cause many injuries:
 - Bike fitting
 - Running form
 - Posture/muscle assessment
 - Correction of imbalances