Level 2:
Indoor Cycling Workshop

Lisa A. Workman

Saturday, February 22, 2014
Overview

- Introductions
- Past to Present
- Exercise Physiology 101
  - Muscle, Heart and Lungs
- The Three Energy Systems
- Training Continuum
- Drills and Skills
Past to Present

1990’s

Power Pacing for Indoor Cycling
Complete workout programs for high-level fitness

Kristopher Kory, Tom Seabourne
Past to Present

1990’s

Present Day
Building Blocks - Where We are Going

- Exercise Physiology
- Energy Systems
- Training Continuum
- Drills and Skills
Exercise Physiology 101

The interaction among the pulmonary, cardiovascular and skeletal muscle systems during exercise

Muscle activity

Peripheral circulation

CO₂ production

Creatine PO₂

Muscle

Pyruvate-Lactate

O₂ consumption

Mitochondrion

O₂ flow

Heart blood

Lungs

Expired

CO₂ flow

Ventilation

\( \dot{V}_a + \dot{V}_o = \dot{V}_t \)

Inspired

\( \dot{V}_{CO_2} \)

\( \dot{V}_{O_2} \)

\( V_a \), ideal alveolar ventilation/time; \( V_n \), physiologic dead space ventilation/time; \( V_t \), total ventilation during expiration/time; \( Q_o \), O₂ consumption; \( Q_{CO_2} \), CO₂ production; \( V_{O_2} \), O₂ uptake; \( V_{CO_2} \), CO₂ output; creatine PO₂, creatine phosphate. Courtesy of Wasserman

© Lisa A. Workman 2014
Muscle: The First Cog in the System
Muscle: The First Cog in the System

- Three types of muscle fibers:
  - Slow Twitch (Type I) Muscle Fibers
  - Fast Twitch (Type IIa) Muscle Fibers
  - Fast Twitch (Type IIb) Muscle Fibers
  - Others?
## Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction Time</td>
<td>How fast a muscle contracts</td>
</tr>
<tr>
<td>Size of Motor Neuron</td>
<td>The size of the electrical carriers</td>
</tr>
<tr>
<td>Resistance to Fatigue</td>
<td>How the muscle gets energy</td>
</tr>
<tr>
<td>Activity</td>
<td>How the muscle gets energy</td>
</tr>
<tr>
<td>Force Production</td>
<td>How many &quot;cellular power plants&quot;</td>
</tr>
<tr>
<td>Mitochondrial Density</td>
<td>How many &quot;cellular power plants&quot;</td>
</tr>
<tr>
<td>Capillary Density</td>
<td>How much blood is present</td>
</tr>
<tr>
<td>Oxidative Capacity</td>
<td>How the muscle uses oxygen</td>
</tr>
<tr>
<td>Glycolytic Capacity</td>
<td>How the muscle uses glucose</td>
</tr>
<tr>
<td>Major Storage Fuel</td>
<td></td>
</tr>
</tbody>
</table>

© Lisa A. Workman 2014
# Slow Twitch (Type I) Muscle Fibers

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction Time</td>
<td>Slow</td>
</tr>
<tr>
<td>Size of Motor Neuron</td>
<td>Small</td>
</tr>
<tr>
<td>Resistance to Fatigue</td>
<td>High</td>
</tr>
<tr>
<td>Activity</td>
<td>Aerobic</td>
</tr>
<tr>
<td>Force Production</td>
<td>Low</td>
</tr>
<tr>
<td>Mitochondrial Density</td>
<td>High</td>
</tr>
<tr>
<td>Capillary Density</td>
<td>High</td>
</tr>
<tr>
<td>Oxidative Capacity</td>
<td>High</td>
</tr>
<tr>
<td>Glycolytic Capacity</td>
<td>Low</td>
</tr>
<tr>
<td>Major Storage Fuel</td>
<td>Triglycerides</td>
</tr>
</tbody>
</table>
## Fast Twitch (Type IIa) Muscle Fibers

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction Time</td>
<td>Fast</td>
</tr>
<tr>
<td>Size of Motor Neuron</td>
<td>Large</td>
</tr>
<tr>
<td>Resistance to Fatigue</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Activity</td>
<td>Long-term Anaerobic</td>
</tr>
<tr>
<td>Force Production</td>
<td>High</td>
</tr>
<tr>
<td>Mitochondrial Density</td>
<td>High</td>
</tr>
<tr>
<td>Capillary Density</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Oxidative Capacity</td>
<td>High</td>
</tr>
<tr>
<td>Glycolytic Capacity</td>
<td>High</td>
</tr>
<tr>
<td>Major Storage Fuel</td>
<td>Creatine Phosphate, Glycogen</td>
</tr>
</tbody>
</table>

© Lisa A. Workman 2014
# Fast Twitch (Type IIb) Muscle Fibers

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction Time</td>
<td>Very Fast</td>
</tr>
<tr>
<td>Size of Motor Neuron</td>
<td>Very Large</td>
</tr>
<tr>
<td>Resistance to Fatigue</td>
<td>Low</td>
</tr>
<tr>
<td>Activity</td>
<td>Short-term Anaerobic</td>
</tr>
<tr>
<td>Force Production</td>
<td>Very High</td>
</tr>
<tr>
<td>Mitochondrial Density</td>
<td>Low</td>
</tr>
<tr>
<td>Capillary Density</td>
<td>Low</td>
</tr>
<tr>
<td>Oxidative Capacity</td>
<td>Low</td>
</tr>
<tr>
<td>Glycolytic Capacity</td>
<td>High</td>
</tr>
<tr>
<td>Major Storage Fuel</td>
<td>Creatine Phosphate, Glycogen</td>
</tr>
</tbody>
</table>
### Characteristics of the Three Muscle Types

<table>
<thead>
<tr>
<th></th>
<th>Slow Twitch (Type I)</th>
<th>Fast Twitch (Type IIa)</th>
<th>Fast Twitch (Type IIb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction Time</td>
<td>Slow</td>
<td>Fast</td>
<td>Very Fast</td>
</tr>
<tr>
<td>Size of Motor Neuron</td>
<td>Small</td>
<td>Large</td>
<td>Very Large</td>
</tr>
<tr>
<td>Resistance to Fatigue</td>
<td>High</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td>Activity</td>
<td>Aerobic</td>
<td>Long-term Anaerobic</td>
<td>Short-term Anaerobic</td>
</tr>
<tr>
<td>Force Production</td>
<td>Low</td>
<td>High</td>
<td>Very High</td>
</tr>
<tr>
<td>Mitochondrial Density</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Capillary Density</td>
<td>High</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td>Oxidative Capacity</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Glycolytic Capacity</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Major Storage Fuel</td>
<td>Triglycerides</td>
<td>Creatine Phosphate, Glycogen</td>
<td>Creatine Phosphate, Glycogen</td>
</tr>
</tbody>
</table>
Exercise Physiology 101

The interaction among the pulmonary, cardiovascular and skeletal muscle systems during exercise

**Muscle activity**
- Peripheral circulation
- CO₂ production
- O₂ consumption
- Mitochondrion

**O₂ and CO₂ transport**
- O₂ flow
- CO₂ flow

**Ventilation**
- (\(V_A + V_D = V_l\))
- Expired
- Inspired
- \(\dot{V}_{O_2}\)
- \(\dot{V}_{CO_2}\)

\(V_a\), ideal alveolar ventilation/time; \(V_d\), physiologic dead space ventilation/time; \(V_t\), total ventilation during expiration/time; \(Q_o\), O₂ consumption; \(Q_{CO2}\), CO₂ production; \(V_{O_2}\), O₂ uptake; \(V_{CO2}\), CO₂ output; creatine PO₄, creatine phosphate. Courtesy of Wasserman

© Lisa A. Workman 2014
Heart: The Second Cog in the System
Heart: The Second Cog in the System
Heart: The Second Cog in the System

Cardiac Output = Heart Rate x Stroke Volume
The interaction among the pulmonary, cardiovascular and skeletal muscle systems during exercise

Muscle activity
- Peripheral circulation
- CO₂ production

O₂ and CO₂ transport
- Pulmonary circulation
- O₂ flow

Ventilation
- O₂ exchange
- CO₂ exchange

Mitochondrion

\[ V_{Aw} \text{ ideal alveolar ventilation/time; } V_{Dw} \text{ physiologic dead space ventilation/time; } V_{A} \text{ total ventilation during expiration/time; } Q_{O2} \]

\[ Q_{CO2}, O_2 \text{ consumption; } V_{O2} \text{ uptake; } V_{CO2} \text{ CO}_2 \text{ output; creatine PO}_4 \text{ creatine phosphate. Courtesy of Wasserman} \]
Lungs: The Third Cog in the System
Lungs: The Third Cog in the System

• Ventilation (V<sub>E</sub>)
  • the amount of air we expire in one minute

• VO<sub>2</sub>
  • the volume of oxygen consumed in one minute

• VCO<sub>2</sub>
  • the volume of carbon dioxide produced in one minute
Lungs: The Third Cog in the System

![Graphs showing relationship between exercise and oxygen consumption (L/min, STPD).](image)
The interaction among the pulmonary, cardiovascular and skeletal muscle systems during exercise

Muscle activity
- Muscle
- Pyruvate-Lactate
- Mitochondrion
- O₂ consumption
- CO₂ production

O₂ and CO₂ transport
- Peripheral circulation
- Pulmonary circulation
- O₂ flow
- CO₂ flow

Ventilation
- \( V_a + V_d = V_t \)
- O₂ uptake
- CO₂ output

\( V_a \), ideal alveolar ventilation/time; \( V_d \), physiologic dead space ventilation/time; \( V_t \), total ventilation during expiration/time; \( Q_O \), O₂ consumption; \( Q_{CO} \), CO₂ production; \( V_{O_d} \), O₂ uptake; \( V_{CO} \), CO₂ output; creatine PO₄, creatine phosphate. Courtesy of Wasserman
Class task

What are the three energy systems?
Energy Systems: The Cogs Working Together as a Team
The Three Energy Systems

Figure 10-1: Sources of production of ATP for muscle contraction

- Anaerobic Alactic Pathway (ATP-CP)
- Anaerobic Lactic Pathway
- Aerobic Pathway

Muscle

ATP
# TERMS!
The Three Energy Systems

<table>
<thead>
<tr>
<th>AFLCA Text</th>
<th>Other #1</th>
<th>Other #2</th>
<th>Other #3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anaerobic Alactic Pathway (ATP-CP)</strong></td>
<td>ATP-phosphocreatine system</td>
<td>Immediate Energy System (ATP-CP)</td>
<td>Phosphagen System</td>
</tr>
</tbody>
</table>

© Lisa A. Workman 2014
## TERMS!
The Three Energy Systems

<table>
<thead>
<tr>
<th>AFLCA Text</th>
<th>Other #1</th>
<th>Other #2</th>
<th>Other #3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anaerobic Lactic Pathway</strong></td>
<td><strong>Anaerobic/Lactate System</strong></td>
<td><strong>Short Term Energy System (Glycolysis)</strong></td>
<td><strong>Glycogen-Lactic Acid System</strong></td>
</tr>
</tbody>
</table>

© Lisa A. Workman 2014
# TERMS!
The Three Energy Systems

<table>
<thead>
<tr>
<th>AFLCA Text</th>
<th>Other #1</th>
<th>Other #2</th>
<th>Other #3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aerobic Pathway</strong></td>
<td><strong>Aerobic System</strong></td>
<td><strong>Long Term Energy System (Aerobic)</strong></td>
<td><strong>Aerobic Respiration</strong></td>
</tr>
</tbody>
</table>

© Lisa A. Workman 2014
## TERMS!

### The Three Energy Systems

<table>
<thead>
<tr>
<th>AFLCA Text</th>
<th>Other #1</th>
<th>Other #2</th>
<th>Other #3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anaerobic Alactic Pathway (ATP-CP)</strong></td>
<td>ATP-phosphocreatine system</td>
<td>Immediate Energy System (ATP-CP)</td>
<td>Phosphagen System</td>
</tr>
<tr>
<td><strong>Anaerobic Lactic Pathway</strong></td>
<td>Anaerobic / Lactate System</td>
<td>Short Term Energy System (Glycolysis)</td>
<td>Glycogen-Lactic Acid System</td>
</tr>
<tr>
<td><strong>Aerobic Pathway</strong></td>
<td>Aerobic System</td>
<td>Long Term Energy System (Aerobic)</td>
<td>Aerobic Respiration</td>
</tr>
</tbody>
</table>
The Three Energy Systems

Figure 3-1: The three systems of energy transfer and their percentage contribution to total energy output during all-out exercise of different durations.

- **Phosphagen system**
  - Sprinter
  - 8-10 seconds (100 m)

- **Glycogen-lactic acid system**
  - Swimmer
  - 1.3-1.6 minutes (400 m)

- **Aerobic respiration**
  - Marathon runner
  - Unlimited time (15 Km)

# The Three Energy Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Rate of ATP Production</th>
<th>Energy Source</th>
<th>Capacity of System</th>
<th>Major Limitation</th>
<th>Major Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anaerobic Alactic Pathway (ATP-CP)</strong></td>
<td>Very rapid</td>
<td>stored creatine phosphate (CP), stored ATP in the muscle</td>
<td>Very limited ATP production</td>
<td>Very limited supply of CP</td>
<td>Very high intensity, short duration sprint activities. During high intensity activities of 1-10 seconds.</td>
</tr>
</tbody>
</table>
# The Three Energy Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Rate of ATP Production</th>
<th>Energy Source</th>
<th>Capacity of System</th>
<th>Major Limitation</th>
<th>Major Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaerobic Lactic Pathway</td>
<td>Rapid rate</td>
<td>Blood glucose, glycogen</td>
<td>Limited ATP production</td>
<td>Lactic acid by product causes rapid fatigue</td>
<td>High intensity, short duration activities. During high intensity activities of 1-3 minutes</td>
</tr>
</tbody>
</table>
## The Three Energy Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Rate of ATP Production</th>
<th>Energy Source</th>
<th>Capacity of System</th>
<th>Major Limitation</th>
<th>Major Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic System</td>
<td>Slow rate</td>
<td>Blood glucose, glycogen, fatty acids</td>
<td>Unlimited ATP production</td>
<td>Relatively slow rate of oxygen delivery to cells</td>
<td>Moderate intensity, longer duration. During moderate to high intensity activities longer than 3 minutes. Fatty acid oxidation dominates after ~20 minutes of exercise.</td>
</tr>
</tbody>
</table>
# The Three Energy Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Rate of ATP Production</th>
<th>Energy Source</th>
<th>Capacity of System</th>
<th>Major Limitation</th>
<th>Major Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anaerobic Alactic Pathway (ATP-CP)</strong></td>
<td>Very rapid rate</td>
<td>stored creatine phosphate (CP), stored ATP in the muscle</td>
<td>Very limited ATP production</td>
<td>Very limited supply of CP</td>
<td>Very high intensity, short duration sprint activities. During high intensity activities of 1-10 seconds.</td>
</tr>
<tr>
<td><strong>Anaerobic Lactic Pathway</strong></td>
<td>Rapid rate</td>
<td>Blood glucose, glycogen</td>
<td>Limited ATP production</td>
<td>Lactic acid by product causes rapid fatigue</td>
<td>High intensity, short duration activities. During high intensity activities of 1-3 minutes</td>
</tr>
<tr>
<td><strong>Aerobic System</strong></td>
<td>Slow rate</td>
<td>Blood glucose, glycogen, fatty acids</td>
<td>Unlimited ATP production</td>
<td>Relatively slow rate of oxygen delivery to cells</td>
<td>Moderate intensity, longer duration. During moderate to high intensity activities longer than 3 minutes. Fatty acid oxidation dominates after ~20 minutes of exercise.</td>
</tr>
</tbody>
</table>

© Lisa A. Workman 2014
Training Continuum
Training Continuum

- Rest
- Long Slow Distance (50-65%)
- Anaerobic Threshold (AT) (75-80%)
- Continuous (just below AT)
- VO$_{2\text{max}}$ (100%)
- Aerobic Limit
Terms

- Long Slow Distance (LSD)
  - exercise intensity at which lactic acid starts to accumulate in the blood stream and CO$_2$ production begins to increase non-linearly
  - lactate removal fails to keep up with the rate of lactate production causing increased in CO$_2$ production
- Anaerobic/Lactic Threshold
  - the maximum volume of oxygen consumed in one minute
Terms

✤ Spin out (RPE = 2-3)
  
  ✤ resistance is low and participants can cycle at their leisure. Good for breaks and cool-downs.

✤ Steady state or Time Trial (RPE = 5-6); just below race pace
  
  ✤ A resistance that can be maintain for a long duration such that you were cycling a long distance (i.e., road trip to Calgary). Maintain revolutions to 20-22 (80-88 RPM).
Terms

- Sprints (RPE = 7-9)
  - Hold a resistance slightly above Time Trial but not as high as a Hill. Increase revolutions to a sprint pace. Make sure that there is enough resistance so that the legs and body are not out of control (i.e., back side jumping up and down on the saddle). Revolutions may increase to 100+ RPM.
Terms

- Hills (RPE = 7-9)
  - Add resistance to simulate hill; Cadence slows to ~ 60 RPM
  - Seated or standing

- Speed/Downhill (RPE = 6-7)
  - Reduce resistance; increase revolutions to 90-100 RPM
  - Fast legs, staying in control, as if you were going down a hill
Terms

- Power (RPE = 8-10)
  - Equals increased speed (RPM) with increased resistance (tension)
  - “Break away from the pack”
  - Fine line between too much speed or too much resistance
  - Short in duration (< 60 seconds each)
- Seated Power / Standing Power
Training Continuum

Rest
Long Slow Distance (50-65%)
Anaerobic Threshold (AT) (75-80%)
Aerobic Limit VO$_{2\text{max}}$ (100%)

Aerobic Energy System
Anaerobic Lactic Energy System
Anaerobic Alactic Energy System
Training Continuum

Rest

Long Slow Distance (50-65%)

Anaerobic Threshold (AT) (75-80%)

Continuous (just below AT)

40 km bike @ race pace

100 km bike @ race pace

VO2max (100%)

Aerobic Limit

© Lisa A. Workman 2014
Training Continuum

100 km bike @ race pace

Long Slow Distance (50-65%)

Anaerobic Threshold (AT) (75-80%)

Continuous (just below AT)

40 km bike @ race pace

Aerobic Intervals
Work: below race pace (training pace)
Rest: short

Aerobic Limit

VO_{2max} (100%)
Aerobic System: Long Term

- **Aerobic Intervals**
  - Aerobic energy system
  - Blood Glucose, Glycogen, Fatty Acids
  - 1:1 Work-to-Rest Ratio
  - 1:0.5 Work-to-Rest Ratio
  - *Example: 3 min flat time trial with 1.5 min spin-out recovery*
Training Continuum

- **100 km bike @ race pace**
- **Long Slow Distance (50-65%)**
- **Anaerobic Threshold (AT) (75-80%)**
- **40 km bike @ race pace**
- **Aerobic Limit (100%)**

- **Aerobic-Anaerobic**
  - Work: race pace
  - Rest: variable
Aerobic + Anaerobic Systems

- **Combination of Aerobic and Anaerobic Capacity/Lactic Systems**

- Moving from aerobic to anaerobic back to aerobic

- 1:2 Work-to-Rest Ratio

- *Example:* 1 minute time trial with 30s sprint; return back to time trial with each sprint interval
Training Continuum

- Rest
- Long Slow Distance (50-65%)
- Anaerobic Threshold (AT) (75-80%)
- Continuous (just below AT)
- VO_{2max} (100%)

AT intervals
- Continuous
- Work: +/- 10%
- Rest:

40 km bike @ race pace

100 km bike @ race pace
Anaerobic System: Short Term

- Anaerobic Threshold Intervals
- Anaerobic Capacity; Anaerobic Lactic
- Glycolysis/Glycogenolysis
- 1:2 Work-to-Rest Ratio
- Example: 30s Seated Power with 1 min spin-out recovery
Training Continuum

100 km bike @ race pace

Long Slow Distance (50-65%)

Anaerobic Threshold (AT) (75-80%)

Continuous (just below AT)

40 km bike @ race pace

Aerobic Limit

VO₂max (100%)

Rest

Anaerobic intervals
Work: ~120% of race pace
Rest: variable
Anaerobic System: Immediate

- **Anaerobic Intervals**
  - Anaerobic Power; Anaerobic Alactic
  - ATP-CP
  - 1:3 Work-to-Rest Ratio
  - *Example*: 15s Sprint with 45s spin-out recovery
Training Continuum

- **100 km bike @ race pace**
  - Long Slow Distance (50-65%)
  - Continuous (just below AT)
  - Anaerobic Threshold (AT) (75-80%)
  - VO\textsubscript{2max} Intervals
    - Work: 90-100%
    - Rest: 30-40%
  - 40 km bike @ race pace
  - VO\textsubscript{2max} (100%)
  - Aerobic Limit

© Lisa A. Workman 2014
Anaerobic System: Immediate

- $VO_{2\text{max}}$ Intervals
  - Anaerobic Power; Anaerobic Alactic
  - ATP-CP
  - 1:2 Work-to-Rest Ratio
  - 1:3 Work-to-Rest Ratio
  - Example: 30s at predetermined $VO_{2\text{max}}$ with 60s recovery
Training Continuum

- **100 km bike @ race pace**
- **AT intervals**
  - Continuous
  - Work: +/- 10%
  - Rest: variable
- **Aerobic-Anaerobic**
  - Work: race pace
  - Rest: variable
- **VO_2max Intervals**
  - Work: 90-100%
  - Rest: 30-40%
- **Anaerobic intervals**
  - Work: ~120% of race pace
  - Rest: variable

**Rest**

- **Long Slow Distance**
  - (50-65%)
- **40 km bike @ race pace**
- **Aerobic Threshold (AT)**
  - (75-80%)
- **Continuous**
  - (just below AT)
- **Anaerobic Intervals**
  - Work: below race pace (training pace)
  - Rest: short

© Lisa A. Workman 2014
Studies have shown that riding a bicycle everyday makes you more awesome than the general population.
Drills and Skills
Drills and Skills

Estimating VO$_{2max}$ intensity with Graded Exercise Test

* Use consistent cadence (80-90 rpm) and slowly increase resistance

* Each bike will vary with how much resistance needs to be added

* Use increments (with tension knobs), levels (with levers) and/or wattage if your computer console provides

* Ensure your starting resistance is clear and emphasize to participants to visually mark where their final VO$_{2max}$ is (if wattage not available)
# Drills and Skills

## Estimating VO$_{2\max}$ intensity with Graded Exercise Test

<table>
<thead>
<tr>
<th>Stage</th>
<th>Resistance</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Time Trial</td>
<td>1 minute</td>
</tr>
<tr>
<td>II</td>
<td>Add increment (gear/turn of tension knob)</td>
<td>1 minute</td>
</tr>
<tr>
<td>III</td>
<td>Add increment (gear/turn of tension knob)</td>
<td>1 minute</td>
</tr>
<tr>
<td>IV</td>
<td>Add increment (gear/turn of tension knob)</td>
<td>1 minute</td>
</tr>
<tr>
<td>V</td>
<td>Add increment (gear/turn of tension knob)</td>
<td>30 seconds</td>
</tr>
<tr>
<td>VI</td>
<td>Add increment (gear/turn of tension knob)</td>
<td>30 seconds</td>
</tr>
<tr>
<td>VII</td>
<td>Add increment (gear/turn of tension knob)</td>
<td>30 seconds</td>
</tr>
<tr>
<td>VIII</td>
<td>Add increment (gear/turn of tension knob)</td>
<td>30 seconds</td>
</tr>
</tbody>
</table>

***The entire drill is in the seated position. If participants need to stand, they have likely found their VO$_{2\max}$ resistance and cadence.***
Vo2Max Intervals

• Work to Rest Ratio - 1:2 or 1:3
  • 15s : 45s at Vo2max gear/tension (1:3)
    • 5 times (5 minutes)
  • 30s : 60s at Vo2max gear/tension (1:2)
    • 5 times (8 minutes)
Drills and Skills

Climb to New Heights Drill Aerobic Intervals

✶ Work to Rest Ratio - 1:0.5

✶ Long duration drill with emphasis on the aerobic energy system

✶ Using the Hill cards from the Indoor Cycling Toolbox, each participant is given a hill card and joins a “team” consisting of the participants sitting in their row (horizontal row)

✶ Depending on the number of participants will dictate the duration of each hill card
Climb to New Heights: Hill Cards Line Drill

<table>
<thead>
<tr>
<th>Number of Participants in Row</th>
<th>Time for each Card*</th>
<th>Total Work (1)</th>
<th>Rest (0.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30s</td>
<td>30s</td>
<td>15s</td>
</tr>
<tr>
<td>2</td>
<td>30s</td>
<td>60s</td>
<td>30s</td>
</tr>
<tr>
<td>3</td>
<td>30s</td>
<td>90s</td>
<td>45s</td>
</tr>
<tr>
<td>4</td>
<td>30s</td>
<td>120s</td>
<td>60s</td>
</tr>
<tr>
<td>5</td>
<td>30s</td>
<td>150s</td>
<td>75s</td>
</tr>
<tr>
<td>6</td>
<td>30s</td>
<td>180s</td>
<td>90s</td>
</tr>
<tr>
<td>7</td>
<td>30s</td>
<td>210s</td>
<td>105s</td>
</tr>
</tbody>
</table>

*Large group of participants in class
Climb to New Heights: Hill Cards Line Drill

<table>
<thead>
<tr>
<th>Number of Participants in Row</th>
<th>Time for each Card*</th>
<th>Total Work (1)</th>
<th>Rest (0.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60s</td>
<td>60s</td>
<td>30s</td>
</tr>
<tr>
<td>2</td>
<td>60s</td>
<td>120s</td>
<td>60s</td>
</tr>
<tr>
<td>3</td>
<td>60s</td>
<td>180s</td>
<td>90s</td>
</tr>
<tr>
<td>4</td>
<td>60s</td>
<td>240s</td>
<td>120s</td>
</tr>
<tr>
<td>5</td>
<td>60s</td>
<td>300s</td>
<td>150s</td>
</tr>
<tr>
<td>6</td>
<td>60s</td>
<td>360s</td>
<td>180s</td>
</tr>
<tr>
<td>7</td>
<td>60s</td>
<td>420s</td>
<td>210s</td>
</tr>
</tbody>
</table>

*Small group of participants in class
Drills and Skills

Time Trial Pace +1 (Race Pace) Interval

• Aerobic Intervals

• Work to Rest Ratio - 1:1

• Below anaerobic threshold

  • Time Trial Pace +1 increment/gear (2 min) : Spin Out (2 min)

• Repeat 2-6 times
Drills and Skills

Pace Line

* Anaerobic Threshold intervals

* Work to Rest Ratio - 1:3

* Group of 4 or more (double up position if needed) on a team

* Each member of the team completes 20 seconds of each drill type as in a pace line

* Each team member completes each drill type three times (i.e., repeat the pace line x3)
# Drills and Skills

## Pace Line

<table>
<thead>
<tr>
<th>Position #1</th>
<th>Seated Power</th>
<th>Standing Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position #2</td>
<td>Time Trial</td>
<td></td>
</tr>
<tr>
<td>Position #3</td>
<td>Time Trial</td>
<td></td>
</tr>
<tr>
<td>Position #4</td>
<td>Spin Out</td>
<td></td>
</tr>
</tbody>
</table>

© Lisa A. Workman 2014
Drills and Skills

Flat to a Climb to a Breakaway from the Pack!

* Aerobic + Anaerobic Intervals

* Work to Rest ratio - 1:2

  * 1 min Time trial + 30s seated hill with last 15s seated power out to the top - Spin out/down hill 30 s - Repeat

  * 1 min Time trial + 30s standing hill with last 15s standing power out to the to - Spin out/down hill 30 s - Repeat
Drills and Skills

Flat to a Climb to a Breakaway from the Pack!

Time Trial 1 minute
Hill Climb 30 s  Power 15 s  Downhill 30 s  Repeat
Drills and Skills

Sprint Pyramid

- Anaerobic Intervals
- Work to Rest Ratio - 1:3
# Drills and Skills

## Sprint Pyramid

<table>
<thead>
<tr>
<th>Work</th>
<th>Rest</th>
<th>Work</th>
<th>Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>5s</td>
<td>15s</td>
<td>25s</td>
<td>75s</td>
</tr>
<tr>
<td>10s</td>
<td>30s</td>
<td>20s</td>
<td>60s</td>
</tr>
<tr>
<td>15s</td>
<td>45s</td>
<td>15s</td>
<td>45s</td>
</tr>
<tr>
<td>20s</td>
<td>60s</td>
<td>10s</td>
<td>30s</td>
</tr>
<tr>
<td>25s</td>
<td>75s</td>
<td>5s</td>
<td>15s</td>
</tr>
<tr>
<td>30s</td>
<td>90s</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Drills and Skills

Power Up Partner Drill

- Anaerobic Intervals
- Work to Rest Ratio - 1:2 and 1:3
- Indoor Cycling Toolbox: One card for each participant
- Pick a partner - ideally, someone beside or on a close bike
Drills and Skills

Power Up Partner Drill (continued)

- Both partners start at a steady state/flat road
- Each partner will alternate calling their card which the other partner will complete for as long as he/she can (ideally, 15-45 s)
- Partners will switch
- Provide 3-5 minutes for the partners to alternate at least 4-5 times
Drills and Skills

Applause!

* Anaerobic Threshold Intervals
* Work to Rest Ratio - ~1:2
  * Lady Gaga!
# Drills and Skills

<table>
<thead>
<tr>
<th>Song Time</th>
<th>Duration</th>
<th>Drill</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 00:55</td>
<td>55s</td>
<td>Lead in time trial</td>
</tr>
<tr>
<td>00:55 - 01:22</td>
<td>27s</td>
<td>Seated Power</td>
</tr>
<tr>
<td>01:22 - 02:03</td>
<td>41s</td>
<td>Spin out - time trial</td>
</tr>
<tr>
<td>02:03 - 02:30</td>
<td>27s</td>
<td>Seated Power</td>
</tr>
<tr>
<td>02:30 - 02:58</td>
<td>28s</td>
<td>Spin out - time trial</td>
</tr>
<tr>
<td>02:58 - 03:26</td>
<td>28s</td>
<td>Seated Power</td>
</tr>
</tbody>
</table>

© Lisa A. Workman 2014
Acknowledgements
Acknowledgements

- Mentor – Kelly Mackenzie-Rife
- Editor – Cameron Brown
- Images – Google and Flickr
References

Resources

http://www.lisaworkman.com/cycle-drills-blog.html
Why I Move.com