# Energy System Training

# Training Energy Systems

- Each energy system meets the body's specific needs during activity.
- Knowledge of these energy systems should affect the training methods of athletes based on the needs of their sport.
- This type of training allows the athletes to be best prepared for their sport, and gives their limited training time a better focus.

# Immediate Alactic

- All training for this system should be powerful (100% intensity) and short (6-12s).
- The recovery time for this system should be minimal (15s-120s).
- Examples:
  - *Running – 10 repetitions of 30m sprints with 30s recovery*
  - *Strength Training – 4 repetitions of 90% maximum load with 30s recovery*
  - *Swim – 8 repetitions of 25m sprints with 30s recovery*

# Effects of Training on Immediate Alactic system

- 20-40% increase of creatine phosphate stores
- increase of ATP stores
- increase in creatine kinase function

# Short Term Lactic Acid

- Training for this system should be fairly powerful (70-95% intensity) and a longer timeframe than immediate alactic training (12s-3 min.).
- The recovery time for this system is also longer (45s-180s).
- *Examples:*
  - *Running – 5 repetitions of 300m sprints with 60s recovery*
  - *Strength Training – 10 repetitions of 70% maximum load with 60s recovery*
  - *Swim – 5 repetitions of 200m sprints with 60s recovery*

# Effects of Training on Short Term Lactic Acid System

- Enables oxygen system to be utilized sooner to limit lactic acid production
- Increases lactic acid removal from muscles
- Increases speed of conversion of lactic acid into glucose

# Long Term Oxygen (Aerobic)

- Training for this system should be low to moderate intensity (40-70% intensity) and have a long timeframe (3 min.- 180 min.).
- The recovery time for this system is the longest (90s – 12 hours).

- *Examples:*
  - *Running – 5k run or 30 minute continuous run*
  - *Strength Training – Circuit training at a low intensity*
  - *Swim – 1500m swim or 30 minute continuous swim*

# Effect of Training on Aerobic System

- Increase in vascularization (# of blood vessels) within muscles.
- Increases size and number of mitochondria in muscle.
- Increases enzyme activity involved in aerobic system.
- Use of fats rather than glycogen for energy.

# Energy Systems in Track and Field

**Table 3.2 Energy System Contributions in Track-and-Field Performance**

| | | | GLYCOGEN | | |
|---|---|---|---|---|---|
| Event | Duration | ATP-CP | Lactic | Aerobic | Triglyceride (fatty acid) |
| 100 m | 10 sec. | 53% | 44% | 3% | — |
| 200 m | 20 sec. | 26% | 45% | 29% | — |
| 400 m | 45 sec. | 12% | 50% | 38% | — |
| 800 m | 1 min. 45 sec. | 6% | 33% | 61% | — |
| 1,500 m | 3 min. 40 sec. | — | 20% | 80% | — |
| 5,000 m | 13 min. | — | 12.5% | 87.5% | — |
| 10,000 m | 27 min. | — | 3% | 97% | — |
| Marathon | 2 hr. 10 min. | — | — | 80% | 20% |

Sources: K.A. van Someren, 2006, The physiology of anaerobic endurance training. In *The physiology of training*, edited by G. Whyte (Oxford, UK: Elsevier), 88; E. Newsholme, A. Leech, and G. Duester, 1994, *Keep on running: The science of training and performance* (West Sussex, UK: Wiley).

# Examples in Different Sports

| Sport | ATP-CP and LA | LA-O2 | O2 |
|---|---|---|---|
| Basketball | 60 | 20 | 20 |
| Fencing | 90 | 10 | |
| Field events | 90 | 10 | |
| Golf swing | 95 | 5 | |
| Gymnastics | 80 | 15 | 5 |
| Hockey | 50 | 20 | 30 |
| Distance running | 10 | 20 | 70 |
| Rowing | 20 | 30 | 50 |
| Skiing | 33 | 33 | 33 |
| Soccer | 50 | 20 | 30 |
| Sprints | 90 | 10 | |
| Swimming 1.5km | 10 | 20 | 70 |
| Tennis | 70 | 20 | 10 |
| Volleyball | 80 | 5 | 15 |