

Guidelines for Improving Cardiorespiratory Fitness

EXS 150
Chap 4a



What are the benefits of achieving optimal cardiorespiratory fitness?

Improved psychological functioning



Decreased mortality (death rates) and morbidity (chronic disease rates)



Improved sleep quality



Improved ability to perform daily activities



Reduction in heart disease risk factors



Biological Energy Cycle

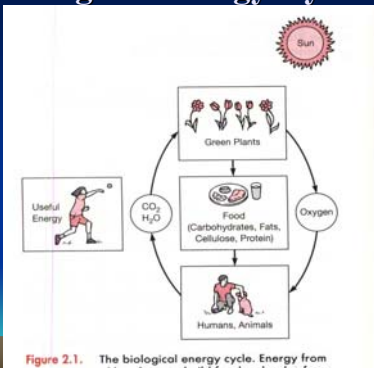


Figure 2.1. The biological energy cycle. Energy from

Where does energy to perform exercise come from?

- Adenosine triphosphate (ATP) – high-energy compound that is synthesized and stored in small quantities in muscle and other cells
 - Break down of ATP yields energy for muscular contraction
 - Immediate source of energy

Energy systems that produce ATP

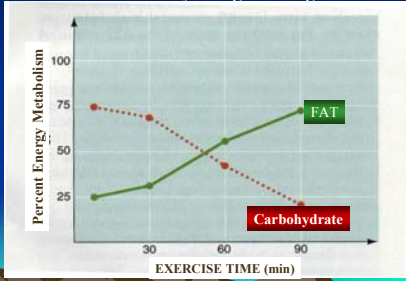
- **Anaerobic** – “without oxygen” – biochemical pathways in cells that do not require oxygen to quickly produce small amounts of ATP
- **Aerobic** – “with oxygen” – biochemical pathways in the cell that use oxygen to produce large amounts of ATP

Anaerobic ATP production

- Breakdown of glucose or glycogen (sugar) in the cell to produce small amounts of ATP

Aerobic ATP Production

Breakdown of macronutrients in order to produce large amounts of ATP for activities of daily living and long duration exercise



Name the metabolic system

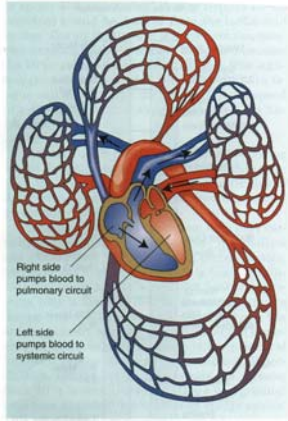
- See Fig 4.2
- What is percent contribution from aerobic and anaerobic metabolism each activity?



What about the heart and lungs?

- Cardiorespiratory system – together the circulatory and respiratory systems are responsible for delivery of oxygen and nutrients and for the removal of waste products from tissues
 - Circulatory (cardiovascular) system – heart and blood vessels
 - Pulmonary circuit – from the rt heart to lungs and back to the left side of the heart
 - Systemic circuit – from the left heart to body and back to the right side of the heart
 - Respiratory system – “lungs”, means of replacing oxygen and removing carbon dioxide from the blood

Circulatory System (Fig. 4.3)



Circulatory system

1. Heart

- Cardiac Output – amount of blood pumped by the heart per minute ($L \cdot \text{min}^{-1}$)
 - Rest = 5 to 7 $L \cdot \text{min}^{-1}$
 - Maximum Exercise = 20 to 30 $L \cdot \text{min}^{-1}$
- Heart rate – number of heart beats per minute ($\text{bts} \cdot \text{min}^{-1}$)
 - Resting – 60 to 80 $\text{bts} \cdot \text{min}^{-1}$
 - Maximum Exercise (age dependent) – 140 to 200 $\text{bts} \cdot \text{min}^{-1}$
- Stroke volume – amount of blood pumped per heart beat (ml)
 - Resting – 50 to 60 $\text{ml} \cdot \text{bt}^{-1}$
 - Maximum Exercise – 70 to 120 $\text{ml} \cdot \text{bt}^{-1}$

Circulatory system (con't)

2. Blood vessels

- Arteries – blood vessels that transport blood away from the heart
- Capillaries – thin-walled vessels that permit the exchange of gases and nutrients to occur between the blood and tissues
- Veins – blood vessels that transport blood away from the heart

Where does blood pressure fit into the equation? Fig 4.4

Blood pressure – pressure generated by the heart during contraction and relaxation that is exerted against the artery walls

- **Systolic blood pressure** – pressure of the blood in the arteries at the level of the heart during the contractile phase of the heart (systole)
 - Normal range from rest to maximum exercise 100 to 240 mmHg
- **Diastolic blood pressure** – pressure of the blood in the arteries at the level of the heart during the relaxation phase of the heart (diastole)
 - Normal range from rest to maximum exercise 60 to 90 mmHg

Do you know someone with high blood pressure?

- High blood pressure or hypertension affects 23% of the population (age 20 to 70 years: CDC, 2001)
- Hypertension – **resting** systolic blood pressure greater than 140 and/or diastolic above 90 mmHg
 - High risk for heart attack and stroke
 - Regular exercise and weight loss have been shown to be effect behavioral treatments for reducing blood pressure in many individuals.
- Do you know your blood pressure?
- DEMO

What's the difference between heart rate, blood pressure, and pulse??



Putting it all together

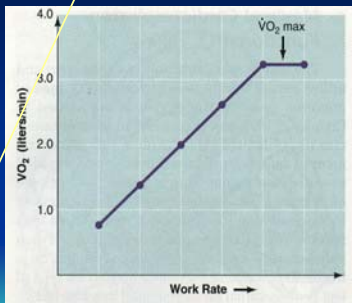
Circulatory System + Respiratory System

Ability to transport and use oxygen
OR
oxygen uptake

Concept of $\dot{V}O_2$ max

The highest oxygen consumption achievable during exercise

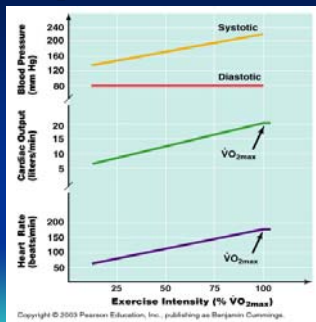
- Usually measured in the laboratory setting and is a measure of cardiorespiratory fitness and the exercising skeletal muscle



What's the "dot" for?

Physiological Responses to Exercise

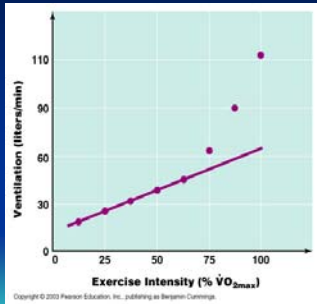
- Circulatory Responses



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Physiological Responses to Exercise

- Respiratory Responses



Physiological responses to exercise

- Metabolic responses (Fig 4.8)

