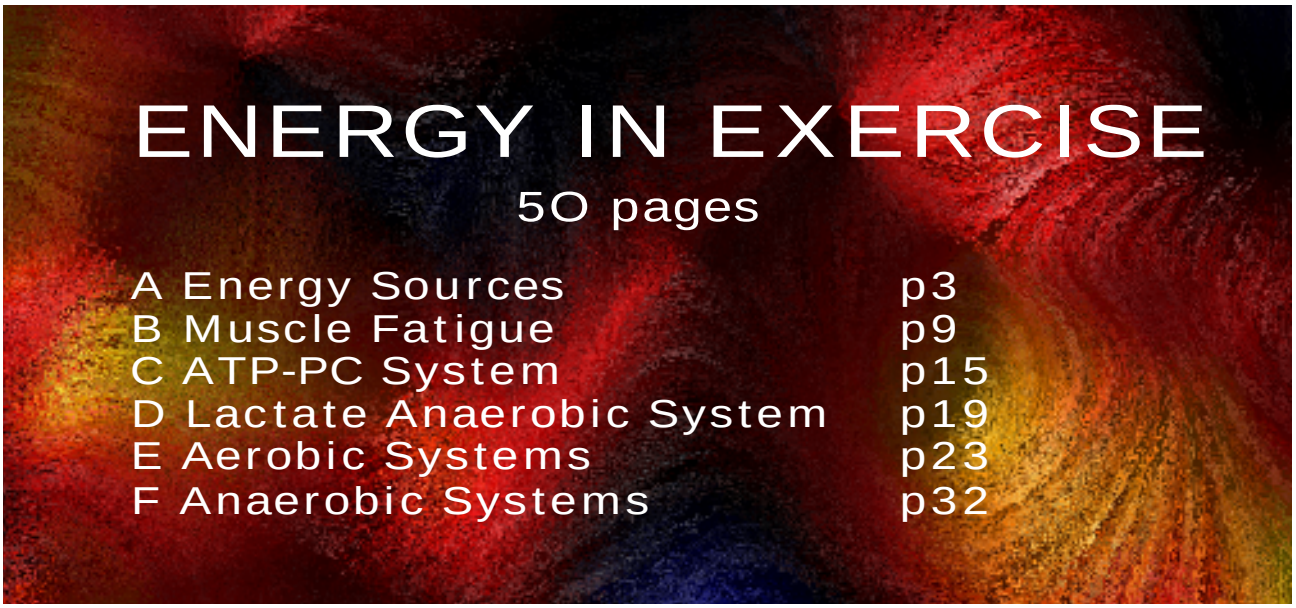
EXERCISE PHYSIOLOGY

Learning Resource



These topics are investigated by means of TASKS consisting of a number of questions embedded in a body of given information in order to reinforce that information.
Answers are provided but can easily be covered if understanding needs testing.

Introduction

The biochemical requirements need to be reduced to make the processes involved understandable to the average non-scientific student.

The premise here is to make students aware that the different demands placed upon elite performers during different performances may be met by energy provision from different sources and through different metabolic processes.

Following the development of the main aspects of the energy systems should be a detailed look at how these systems operate under differing conditions, with the emphasis on the idea of a predominant energy system rather than switching on and off of particular systems.

Understand the idea of the main foods used as energy sources and their location within the body

Appreciate the inter-relationship between the different sources of energy

Be able to apply these principles to observed performance

The idea of foodstuffs being utilised as energy sources is relatively simple to understand, any problems that arise are usually due to the nomenclature used, which may confuse non-scientists. In order to avoid this it is best to keep terminology to a minimum and avoid knowledge of alternative terms.

Students are asked to work through a series of fairly simple tasks. All the tasks involved require the students to work either from the tasks as free-standing units, or to use the tasks as additional reinforcement and/or revision to class-delivered lessons.

A Energy Sources

Task 1

Read through the following materials, answering the questions in the spaces provided.

We obtain our energy from the food we eat, namely carbohydrates, fats and proteins.

a For each of carbohydrates, fats and proteins suggest 2 foods that contain a high proportion of these nutrients.

carbohydrates – bread/cakes/rice/pasta/potatoes.

fats – butter/cream/lard/oil.

proteins – meat/chicken/cheese.

Following digestion, these chemicals will become **glucose**, **fatty acids** and **glycerol**, and **amino acids** respectively. These substances enter the blood system and become available for the body. Glucose in the blood system may be used by working muscles as a source of energy. Excess glucose that enters the blood following a meal is stored in muscles and the liver as **glycogen**.

Task 1 *continued*

b What are the principle forms of carbohydrate found in the body, and how do these forms differ?

Glycogen and glucose; Glycogen is the insoluble storage form of carbohydrate found in liver and muscle; Glucose is the soluble blood-based form.

When our glycogen stores are full, then the excess glucose is converted to fat and stored in **adipose tissue**, which lies just under the skin. When required fats may be converted into glycerol and fatty acids. Glycerol and fatty acids (free fatty acids) may be used directly from the blood, but most are converted back into fats and stored as **triglycerides** in adipose tissue.

Glycerol may be converted into glucose, which is what happens when the diet is deficient in carbohydrate, or when glycogen stores have been depleted, as happens during a marathon.

c Explain in your own words how excess carbohydrate and fat are stored by the body.

Excess carbohydrate and fat are stored as fat droplets in cells within adipose tissue

Task 1 *continued*

Amino acids are usually used by the body for growth and repair, but unlike carbohydrates and fats, excess amino acids cannot be stored. Instead they are broken down by the liver (**deamination**), and the nitrogen-containing part of the molecule is excreted as urea. When we exercise, the remainder of the deaminated amino acid may be converted into glucose, or used in some stage of the energy production system. Up to 10% of our energy demands may be met through protein breakdown.

To a certain extent, the food sources are inter-convertible. This is predominantly a function of the liver. In practice, some conversions are easier than others. Thus the liver readily converts excess glucose into fat, but less readily into glycogen. The reverse reactions, converting glycogen into glucose are easily done in the liver, but less readily accomplished in muscles, whilst very little glucose can be produced from fat.

When we are resting, approximately a half to two thirds of our energy comes from fats, whilst the remainder comes from carbohydrate. This ratio alters when we exercise, but the exact proportions depend on many factors such as the type of exercise, the type of diet, the level of fitness and the type of muscle involved.

Muscles are able to use their stored glycogen as an immediate source of energy at the start of exercise and during intense exercise. During such times, the supply of oxygen to the muscles is limited and therefore complete aerobic breakdown is not possible.

d Why is the complete breakdown of glucose and fat to provide energy called an aerobic process?

Because it uses oxygen