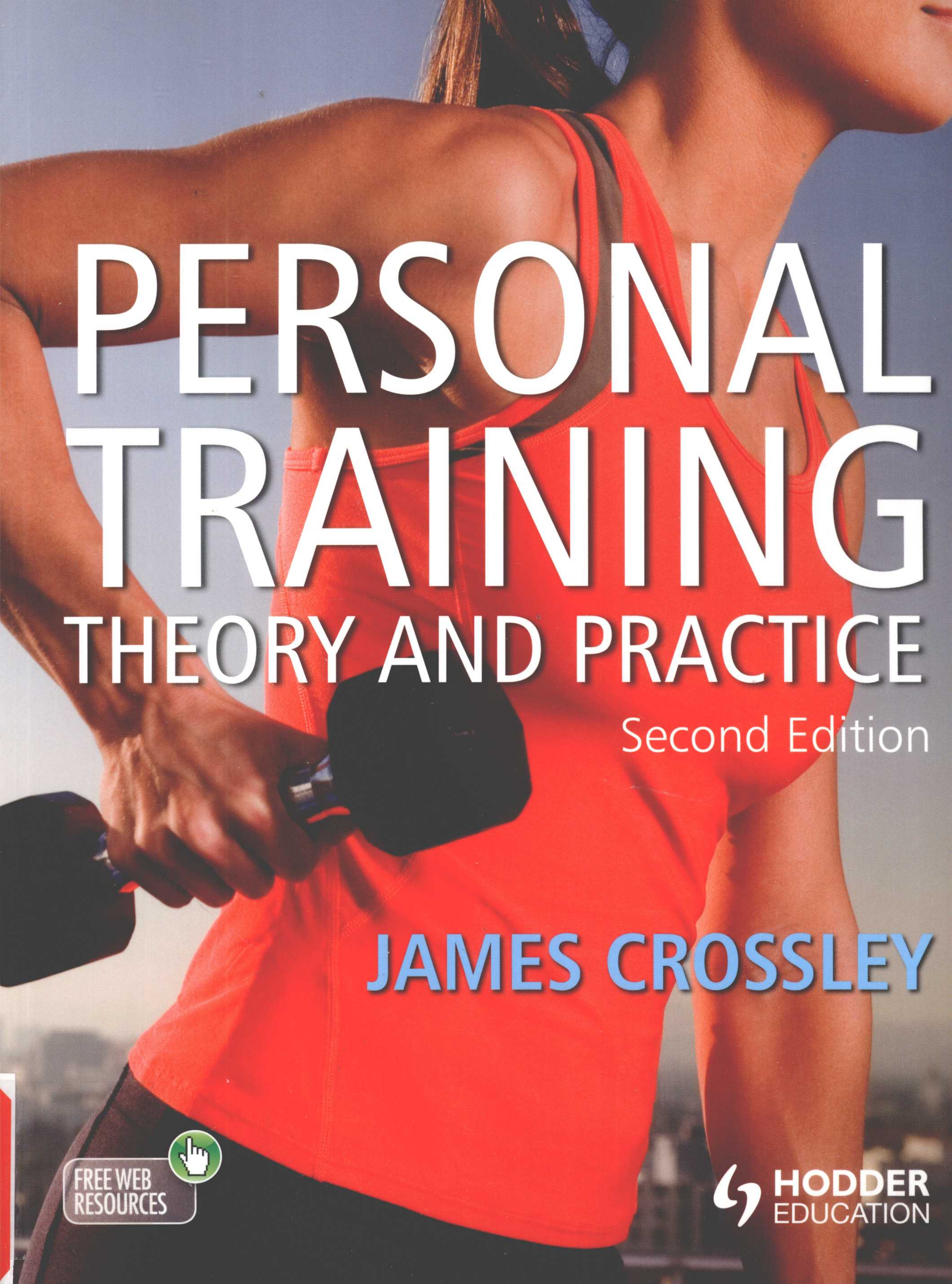


PERSONAL TRAINING

THEORY AND PRACTICE

Second Edition

JAMES CROSSLEY

FREE WEB RESOURCES

HODDER EDUCATION

G807
164-2

PERSONAL TRAINING

Theory and Practice

常州大学图书馆
藏书章

JAMES CROSSLEY

HODDER EDUCATION
AN HACHETTE UK COMPANY

Ep 297

Dedicated to my mother and father, my lifelong inspiration.

Orders: please contact Bookpoint Ltd, 130 Milton Park, Abingdon, Oxon OX14 4SB. Telephone: (44) 01235 827720. Fax: (44) 01235 400454. Lines are open from 9.00 – 5.00, Monday to Saturday, with a 24-hour message answering service. You can also order through our website www.hoddereducation.co.uk.

If you have any comments to make about this, or any of our other titles, please send them to educationenquiries@hodder.co.uk.

British Library Cataloguing in Publication Data
A catalogue record for this title is available from the British Library

ISBN 978 1 444 14546 5

First Edition published 2006
Second Edition published 2012
Impression number 10 9 8 7 6 5 4 3 2 1
Year 2012 2013 2014 2015 2016

Copyright © 2006, 2012 James Crossley

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the publisher or under licence from the Copyright Licensing Agency Limited. Further details of such licences (for reprographic reproduction) may be obtained from the Copyright Licensing Agency Limited, Saffron House, 6–10 Kirby Street, London EC1N 8TS.

Every effort has been made to trace copyright holders. Any omissions brought to our attention will be corrected in any future printings.

Cover photo © Erik Isakson/Tetra Images/Jupiter Images

Hodder's policy is to use papers that are natural, renewable and recyclable products and made from wood grown in sustainable forests. The logging and manufacturing processes are expected to conform to the environmental regulations of the country of origin.

Typeset by Integra Software Services Pvt. Ltd., Pondicherry, India

Printed in Italy for Hodder Education, an Hachette UK Company, 338 Euston Road, London NW1 3BH.

INTRODUCTION

The health and fitness industry is growing rapidly in the UK, alongside a tide of weight-related illness such as heart disease, diabetes and back pain caused by inactivity and poor nutrition. We are also seeing a rise in the popularity of personal trainers to help people remain healthy and improve their body shape, and many of the large health club chains now offer personal training to their members. The number of people seeing personal training as a potential career is increasing. This book is aimed at personal trainers looking to start out or advance their skills in order to be successful in this competitive new field.

As a personal trainer in the UK you will be able to charge fees of anything between £15 and £100 per hour. This may sound like a lot of money and the one thing that will make your fee truly justifiable is *results*. Your clients will expect sufficient guidance and motivation to achieve their goals. A personal trainer has to deliver exercise sessions of a quality far and above that normally offered within any health club or gym.

At any one time you may have on your books clients with goals that vary widely, from improved posture, reduction of chronic pain, improved sport performance, weight loss, toning, to improved health and fitness. To deal effectively with these you must have an in-depth understanding of a broad range of topics and disciplines. You must be able to design effective programmes, provide guidance with regard to diet, help reduce chronic pain such as backache and, most importantly, be able to motivate your clients sufficiently to make them come back.

This book combines the underpinning theory and the practical application of topics such as *functional exercise* and *sport-specific training*. We provide insight into key issues involved in personal training such as *core stability* and *Swiss ball exercise*. We also provide core skills that a trainer should have at their disposal, such as *assisted/partner stretching* and *nutritional analysis*, as well as scientifically validated motivation tools to ensure you keep your clients on track.

A 'good' personal trainer will always know why they are asking the client to do what they are doing. They will have scientifically supported reasons for prescribing their exercises and will know the reasons behind everything that they say and ask. Unfortunately 'good' personal trainers are not always 'successful' ones. There are many trainers who are highly knowledgeable with regard to exercise science, but who simply lack the communication skills, sales technique and professionalism to find clients and make personal training a financially viable career. As well as providing advice on *sales and marketing* this text explains how to provide sessions that deliver far more than the usual gym induction or gym tours that are offered free of charge in most health clubs. This will enable you to bridge the gap in terms of quality of customer service, professionalism, skill and knowledge to warrant your fees.

By combining theoretical principles with practical applications this book is ideal for any instructor starting out, as well as for the established personal trainer looking to update their knowledge.

CONTENTS

此为试读，需要完整PDF请访问：www.ertongbook.com

ACKNOWLEDGEMENTS

All photographs (except those listed below) provided by Sam Bailey.

The following photographs have been supplied by Mark Scowen: seated dumbbell shoulder press on page 39; one-arm dumbbell row on page 40; supine bicep press on page 40; Figure 8.13 on page 112; Figure 8.14 on page 112; Figure 8.15 (a) & (b) on page 113; Figure 8.16 (a) & (b) on page 113; Figure 8.17 (a) & (b) on page 113; Figure 8.18 on page 114; Figure 13.01 on page 194; Figure 13.02 (b) on page 195; Figure 13.02 (c) on page 195; Figure 13.03 (a) on page 196; Figure 13.03 (b) on page 196; Figure 13.03 (c) on page 196.

Figure 9.2 on page 130 is copyright SG-Fotolia.

Figure 9.3 on page 130 is copyright © Jessica Rinaldi/Reuters/Corbis.

The author and publisher would like to thank to Holmes Place for use of their facilities and to Ian, Adele and Shaun for their help.

1 ANATOMY AND PHYSIOLOGY

This chapter contains

Before we start to cover aspects of exercise prescription, it is important to have a basic knowledge of how the body works. The better our anatomical and physiological knowledge, the better our exercise prescription will be. The following chapter provides a structural and functional insight into different aspects of the human body. Although the information is a brief overview, the areas covered are of particular importance to personal trainers.

ANATOMICAL AND DIRECTIONAL LANGUAGE

When we talk about a particular exercise it is common for people to have their own personal names for the exercises they do. It is important that exercise professionals have a common language and use common terminology so that communication is clear and concise. We should also have clear descriptive terms to describe what position the body is in or to pinpoint a particular part of the body. This is why it is important to use correct anatomical and directional language.

Whenever we talk about a part of the body, we generally talk as if the person is starting in the anatomically correct position. This is standing with head, eyes, toes and palms facing forwards.

Positional terminology

We generally refer to points in relation to a central midline or middle point. Here are some of the more common terms used to describe where a point is on the body.

- Proximal – Nearer the trunk
- Distal – Further away from the trunk
- Superior – Above (also known as cephalic)
- Inferior – Below (also known as caudal)
- Anterior – Towards the front of the body (also known as ventral)
- Posterior – Towards the rear of the body (also known as dorsal)
- Medial – Towards the midline of the body
- Lateral – Away from the midline of the body
- Superficial – Towards the surface of the body
- Deep – Being further from the surface of the body
- Internal – On the interior (inner)

- External – On the exterior (outer)
- Central – Towards the centre
- Peripheral – Further way from the centre
- Ipsilateral – The same side
- Contralateral – Opposite side
- Muscle origin – Proximal muscle attachment
- Muscle insertion – Distal muscle attachment
- Supine position – Lying facing upwards
- Prone position – Lying facing downwards
- Recumbent – Lying down
- Palmar surface – The anterior surface
- Plantar surface – The inferior surface.

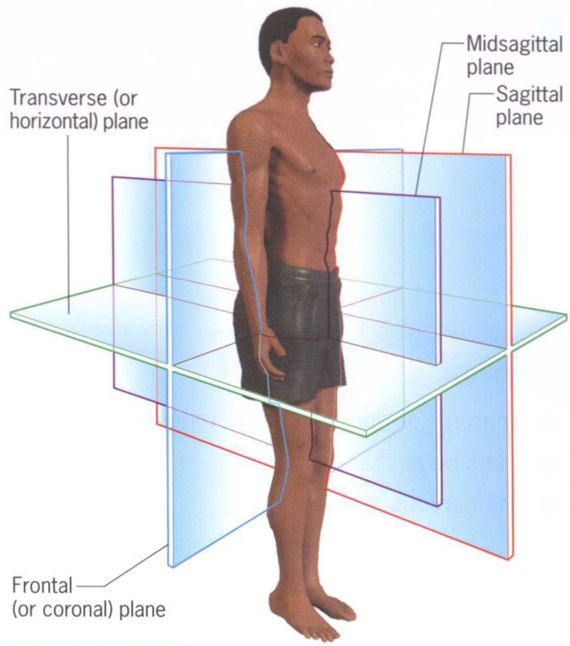
Movement terminology

This is terminology used to describe certain movements at different joints of the body.

- Flexion – Bending or decreasing the angle between body parts
- Extension – Straightening or increasing the angle between body parts
- Abduction – Movement away from the midline
- Adduction – Movement towards the midline
- Rotation – Turning around an axis or pivot point
- Circumduction – Circular movement combining flexion, extension abduction and adduction
- Eversion – Moving sole of foot outwards
- Inversion – Moving sole of foot inwards
- Supination – Turning the palm to face anteriorly
- Pronation – Turning the palm to face posteriorly
- Internal rotation – Rotation towards the midline
- External rotation – Rotating away from the midline.

Planes of motion and axis of rotation

Anatomical descriptions can also be based on three imaginary planes or flat surfaces that pass through the body. These are called the sagittal, frontal and transverse planes. Imagine if we were looking straight onto a person in the anatomically correct position and cut through the body using these three different planes. The mid-sagittal plane would cut the body into two halves, left and right. The frontal plane separates us into front and back or anterior and posterior and the transverse plane runs parallel to the ground, separating us into superior and inferior (Figure 1.1).



1.1 Body planes

Movement along these planes means that no body mass crosses this sheet. So, for example, movement along the sagittal plane only allows movement forwards and back (flexion and extension). Sagittal plane exercises might include crunches, chest presses, leg extensions or bicep curls. Exercises along a frontal plane would only allow movement side to side (abduction and adduction): a side-bend, for example. Exercises along the transverse plane would only allow turning or twisting (medial or lateral rotation).

An axis of rotation is simply a pivot point around which we move. There are three main axes: the sagittal axis is like a rod going horizontally across our body from side to side, the frontal axis goes straight through our middle and the transverse axis passes straight through our body from head down through to the floor as if passing through our spine. Exercises can be classified according to which plane of motion and axis of rotation they involve.

The rest of this chapter looks at the anatomy and physiology of the body, providing brief descriptions about how each system works and relates to each other.

THE KINETIC CHAIN

The ***kinetic chain*** is a term used to describe all the nerves and muscles used to move bones and joints during movement (Figure 1.2).

> kinetic chain: The sum total of the nervous action and muscular action to move bones and joints involved in any particular movement.

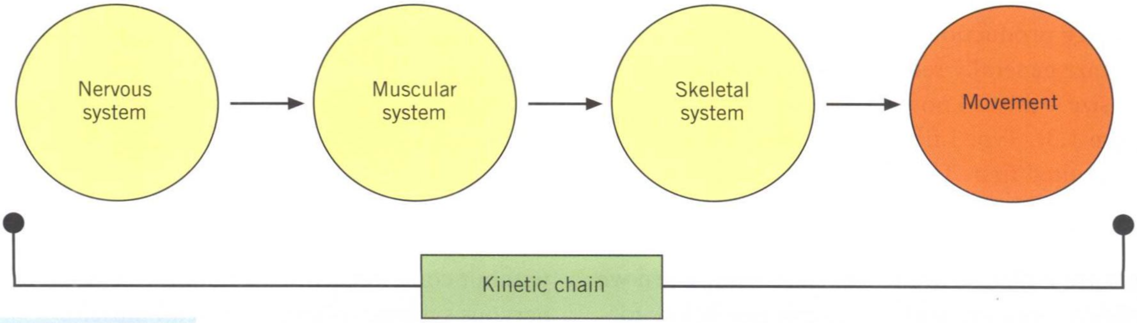
Kinetic refers to a force and the word *chain* suggests that all the different segments are linked or connected together. As a trainer it is essential that we know how these different segments of the chain work and how they interrelate and work together to produce human movement. The following information provides some basic information about each part of this kinetic chain.

THE NERVOUS SYSTEM

The nervous system drives human movement. It ultimately determines when and how we move and the quality of these movements, as well as how much force our muscles can produce. The nervous system consists of both central (central nervous system, CNS) and peripheral (peripheral nervous system, PNS) branches. The CNS includes the brain and spinal cord and is effectively the decision-making part of the nervous system. The PNS is concerned with transmitting information between the CNS and other parts of the body.

The afferent system (afferent means to 'carry toward') is composed of ***sensory neurons*** (or nerves) that detect changes in the environment and provide feedback to the brain. The efferent system (efferent means 'carrying from') sends information from the brain to different 'effector organs'. This includes ***motor neurons*** that transmit impulses from the brain to drive the muscles. ***Interneurons*** communicate information between the two.

> **KEY POINTS**
>
> **Sensory neurons** transmit information from the senses to the brain
> **Motor neurons** drive muscles
> **Interneurons** communicate between the two above.

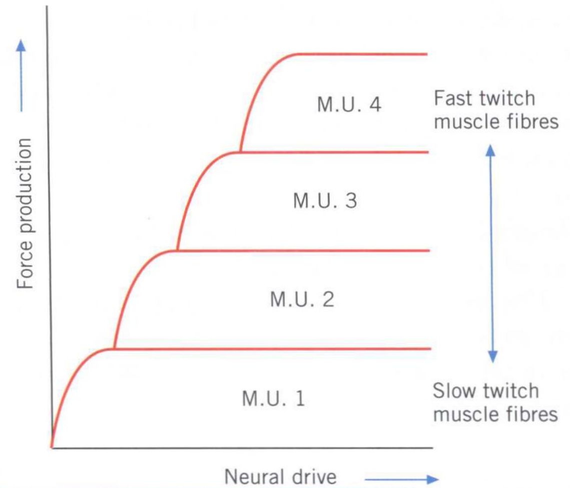


1.2 The kinetic chain

The motor neuron and the muscle fibres it connects to are known as a ***motor unit***. Each muscle fibre is connected to the brain by one motor neuron, but each motor neuron innervates many muscle fibres. The number of fibres that a single motor neuron innervates is dependent upon the level of control required in that muscle. A small muscle required for fine control will be controlled by far more motor neurons than a large muscle used for less accurate but more powerful movements.

The point at which the motor neuron connects to the muscle fibre is known as the ***neuromuscular junction***. An electrical signal is sent through the motor nerve from the brain to activate the muscle fibres. This electrical signal is called an ***action potential***. A single action potential causes a submaximal muscle action called a ***twitch***. When action potentials are repeated rapidly, twitches combine to increase the level of force produced by the muscle.

The nervous system controls how much force a muscle produces. It achieves this by controlling the rate at which individual motor units are firing (rate coding) and by controlling how many motor units are involved in a muscle contraction (***recruitment***) (Enoka, 1988). Much of the improvements in strength in the initial stages of training for a novice will be improvements in the ability of their nervous system to increase rate coding and recruitment in muscles (Moritani and DeVries, 1979). The effort we put into muscle recruitment can be called ***neural drive***. As neural drive increases, more muscle fibres are recruited and force production rises. Motor units or muscle fibres are generally recruited in accordance to their size – this is known as the ***size principle*** (Figure 1.3). Type I fibres are generally smaller, so are recruited first. They are said to have a low recruitment threshold; that is, the amount of effort needed to activate them is low. Type II fibres are larger, so are recruited second, when we require a more forceful movement (see below for details on muscle fibre type).



1.3 Motor recruitment (MU = Motor unit)

As we see in Chapter 9, the nervous system is the driving force behind movement, dictating how much muscle force we can produce, how we create movement and how accurate these movements are. Chapter 9 will also look at how we can train and improve the function of the nervous system with regard to producing movement.

THE MUSCULAR SYSTEM

Muscles comprise the largest group of tissues in the body, accounting for half of the body's weight (Sherwood, 1993). There are three main types of muscle:

1. skeletal muscle, which is known as *voluntary* because we have conscious control over its action
2. cardiac muscle that forms the wall of the heart
3. smooth muscle that forms the walls of most vessels and organs.

The latter two are both *involuntary* – they work without conscious effort. Under the control of the nervous system, voluntary skeletal muscles contract, creating forces that, if they are greater

此为试读，需要完整PDF请访问：www.ertongbook.com

than external resistance, will produce movement in our skeletal system.

The structure of the skeletal system

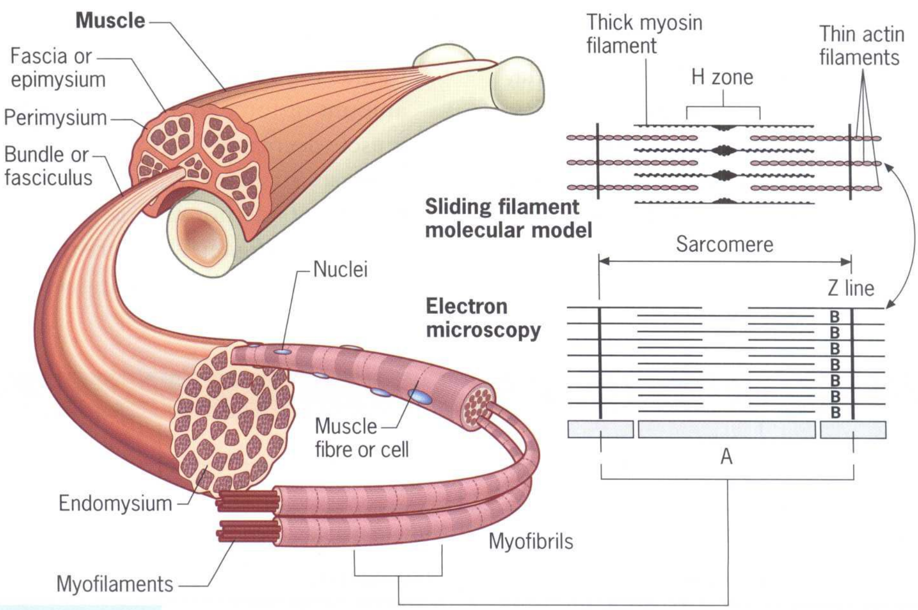
Muscle is composed of many individual muscle fibres wrapped together in bundles (Figure 1.4). A type of connective tissue known as *fascia* covers these various bundles of fibres. The outer layer that covers the whole muscle is called the *epimysium*. The epimysium runs into the *tendon* of the muscle that attaches and transmits force to the bone. Under the epimysium there are bundles of muscle fibres known as the fascicles, wrapped in fascia called the *perimysium*. Each of these muscle fibres is wrapped in a connective tissue called the *endomysium*. Each muscle fibre is made up of building blocks of muscle called *myofibrils*.

The myofibril contains specialized proteins that allow contraction of muscle called myosin and actin. Actin and myosin run parallel with each other. The thick myosin filaments have small heads called cross-bridges. Under an electrical stimulus from motor neurons these cross-bridges interact with, bind to and pull against the thin actin filaments. This pulls the actin and myosin filaments together to produce movement. This process is known as the sliding filament theory (Figure 1.4).

Muscle fibre typing

Skeletal muscles are composed of many different fibres. Not all these fibres have the same characteristics. Fibres have been characterized based on the force they produce under a single action potential (see above). Some muscle fibres produce large amounts of force quickly and are quick to relax. These are known as fast twitch fibres. Some fibres produce lower levels of force, take more time to develop force and are slower to relax. These are known as slow twitch fibres.

Different fibres have different biochemical and physical properties. Muscle fibres have been categorized based on these different properties.



1.4 Skeletal muscle structure

Some have good resistance to fatigue, being able to produce low levels of force but over long periods of time. These muscle fibres are known as type I fibres. Others can develop force very quickly (fast twitch), and produce high levels of force due to their particular metabolic make-up. Unfortunately these fibres are often very quick to fatigue. They are called type II fibres. The type II fibres have been further broken down into type IIa and type IIb, with type IIa being almost a middle category combining properties from both extremes. Type I fibres are generally suited to performing more postural and stabilizing roles, whereas type II fibres are recruited when more explosive, powerful movements are required (Table 1.1).

Individuals who have muscles that are predominantly type I generally make better endurance athletes such as long-distance runners. Individuals with muscles that have a higher proportion of type II fibres are generally suited to more explosive activities such as sprinting, jumping or throwing. Training can alter our muscles' fibre types. There is little evidence to suggest that type II fibres will change into type I fibres with endurance training but there may be a gradual conversion of type IIb fibres to type IIa, increasing the aerobic or endurance capabilities of that muscle at the expense of speed and power (Kraemer *et al*., 1995). There is no evidence for the conversion of type I fibres into type II with strength-to-power training (Jones and Round, 1995).

Other factors determining muscle strength

Along with neural drive, other factors determining the amount of force our muscles can produce include the following.

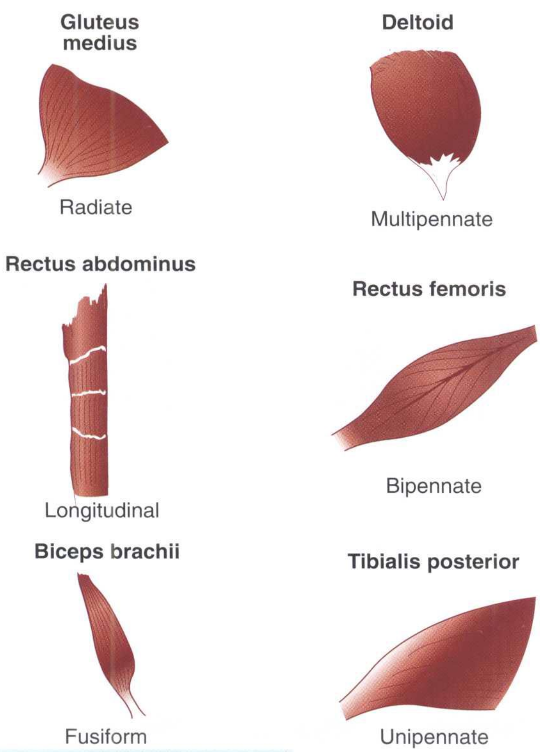
- ***Muscle cross-sectional area***: Larger muscles containing either more or larger muscle fibres are potentially able to generate more force than smaller muscles.
- ***Length–tension relationships***: A muscle has a resting length at which its biomechanics are optimal and it is able to produce the largest amount of force. As a muscle's length becomes shorter or longer than this, the biomechanics become less efficient and the amount of force it can produce decreases.
- ***Joint angle***: As we go through a movement the angle at the joint changes. This has the effect of changing lever arms (see below), changing muscle lengths and changing the muscles that have a mechanical advantage or that can take part in a movement. In this way the joint angle can have a large impact on the amount of force produced.
- ***Load–velocity relationships***: It has been shown that as the velocity of contraction increases, the amount of force that can be produced by a muscle decreases. This is why highly explosive exercises such as Olympic lifting and jumping movements do not require great load.
- ***Muscular fatigue***: There are three different types of fatigue; muscle fatigue, neuromuscular

Characteristic	Type I	Type IIa	Type IIb
Twitch contraction time	Slow	Fast	Fast
Contraction speed	Slow	Fast	Fast
Force production	Low	Intermediate	High
Endurance	High	Intermediate	Low

Table 1.1 Major characteristics of muscle fibre types

fatigue and central fatigue. Muscle fatigue may be due to the accumulation of waste products such as lactic acid (see Chapter 4) and depletion of energy stores, and is more likely to occur during endurance-based activities. Neuromuscular fatigue occurs when motor neurons cannot activate muscle fibres because they are unable to synthesize certain chemical transmitters quickly enough. This is more likely during faster, more powerful activities. Central or psychological fatigue occurs when the CNS can no longer activate motor neurons with which to drive muscles.

- *Muscle architecture*: Muscle fibres can be arranged in different patterns, and this affects the amount of force they can produce (Figure 1.5). Different muscles are usually adapted to perform specific functions. For example, fusiform muscles (e.g. biceps brachii) have parallel fibres, which produce very precise contractions, whereas in pennate muscles the fibres are arranged in a feather-like pattern, obliquely to the line of pull, making them very powerful (e.g. deltoid muscle). Fibres can even have a twist in them, giving them a lot of power in a very localized area (e.g. the latissimus dorsi). There are many different fibre arrangements affecting the properties and force production in muscle.



1.5 Muscle fibre arrangement

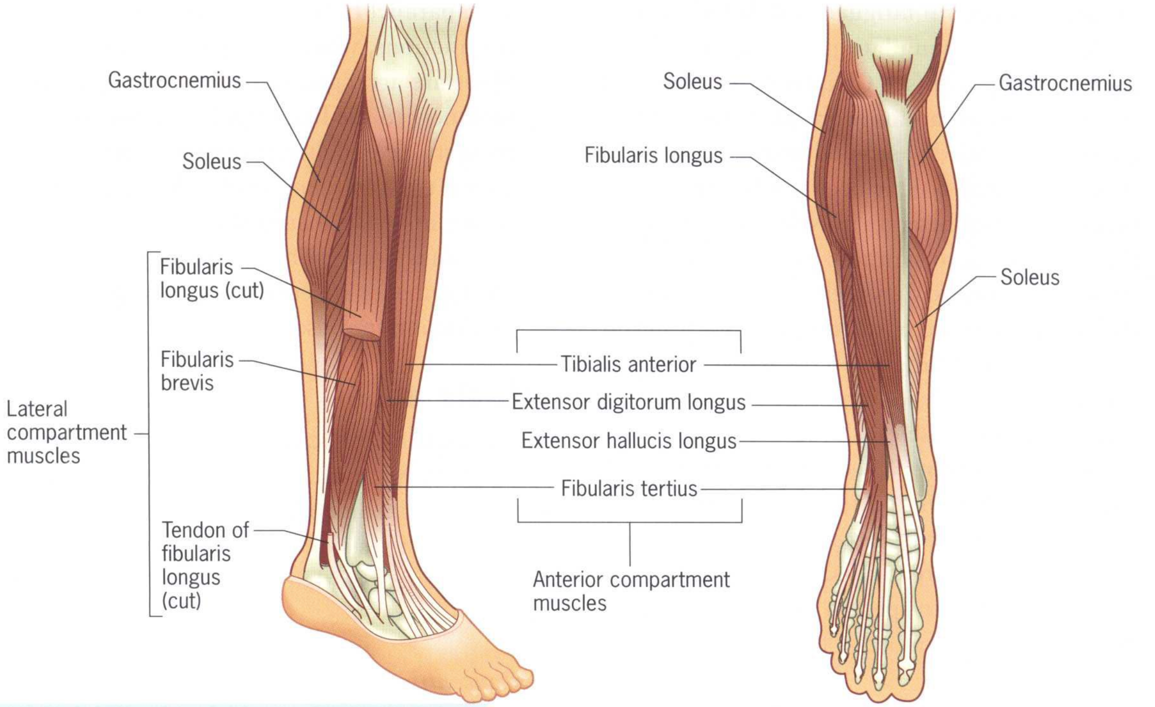
Muscle action

There are three basic types of muscle action during which a muscle generates force: concentric, eccentric and isometric. As muscles contract, they do so against resistance. Although the term 'contract' suggests that the muscle shortens, this is not always the case.

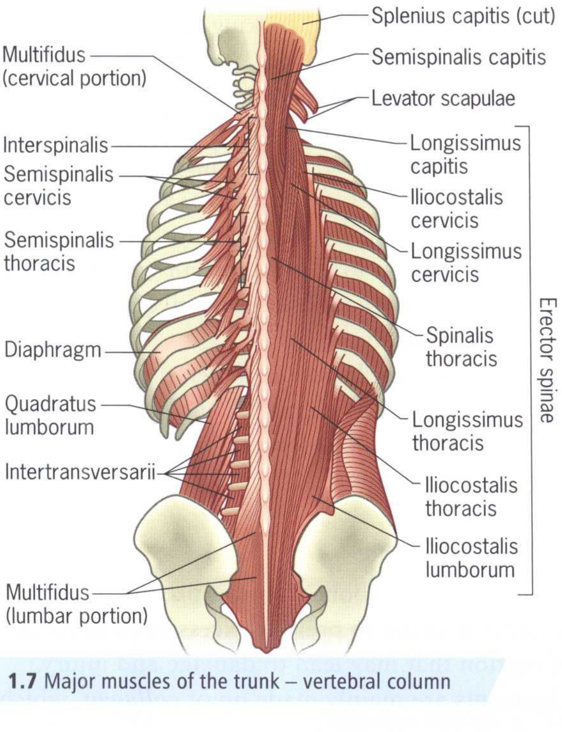
- *Concentric muscle action*: The muscle overcomes the resistance against which it is applying force and as a result the muscle shortens.
- *Eccentric muscle action*: The resistance against which the muscle is working is greater than the muscular force produced and the muscle lengthens in a contracted state. This occurs when lowering a weight, for example. The mechanics of muscle action mean that it is possible to generate more force eccentrically than concentrically. This means that we can slowly lower a load greater than we can lift, which serves as a useful protective mechanism against excessive loads.
- *Isometric muscle action*: When the muscular force production is equivalent to the resistance, the result is a static contraction in which there is no movement.

Ligaments

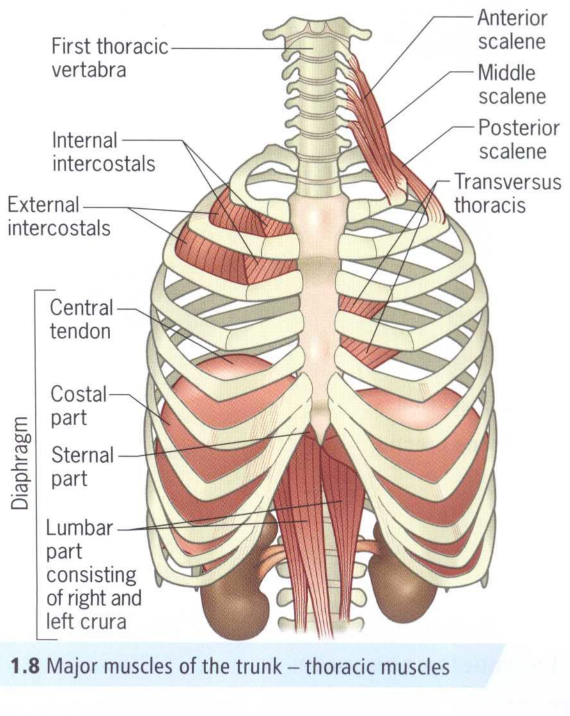
Ligaments attach bone to bone, providing static stability in order to prevent excessive joint range of motion that may lead to damage and injury. Ligaments are mainly made up of ***collagen***, which



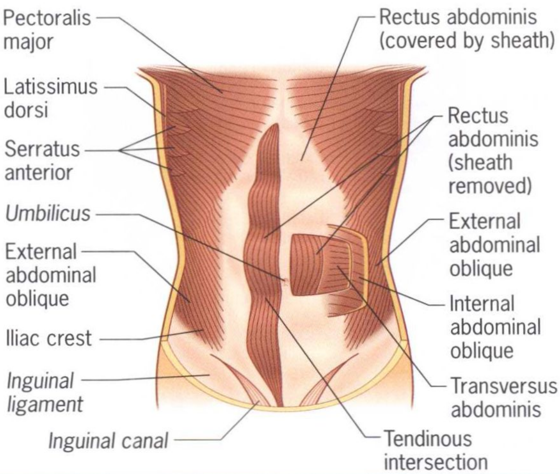
1.6 Major muscles of the lower leg, ankle and foot



1.7 Major muscles of the trunk – vertebral column



1.8 Major muscles of the trunk – thoracic muscles

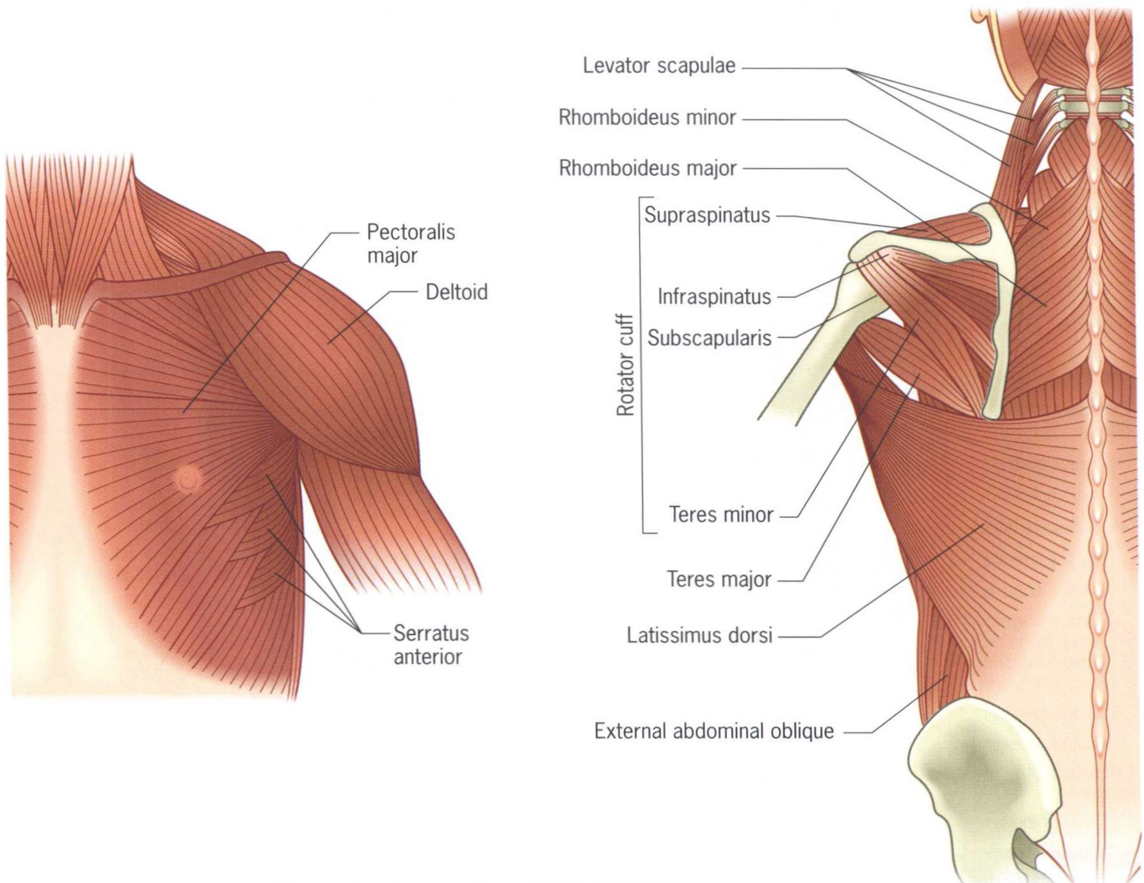


1.9 Major muscles of the trunk – abdominal wall muscles

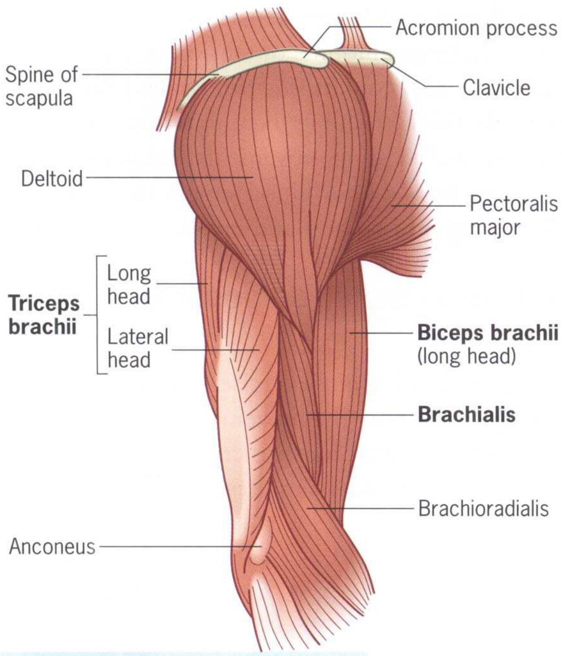
is a substance with great tensile strength (i.e. it will resist large amounts of tension or pull). Ligaments also contain ***elastin***, which provides some elasticity, enabling them to withstand bending and twisting movements. Because ligaments have a poor blood supply they often take a long time to heal and recover from injury.

Muscle actions: origins and insertions

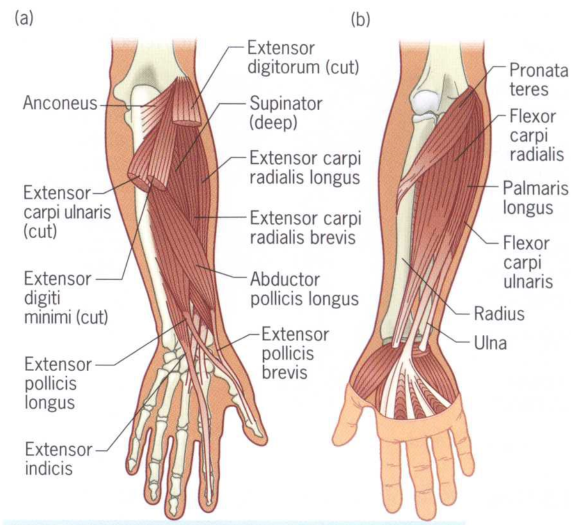
Before prescribing any exercise regime it is important to know the movements available at each joint and what muscles create these movements. To understand truly how muscles are



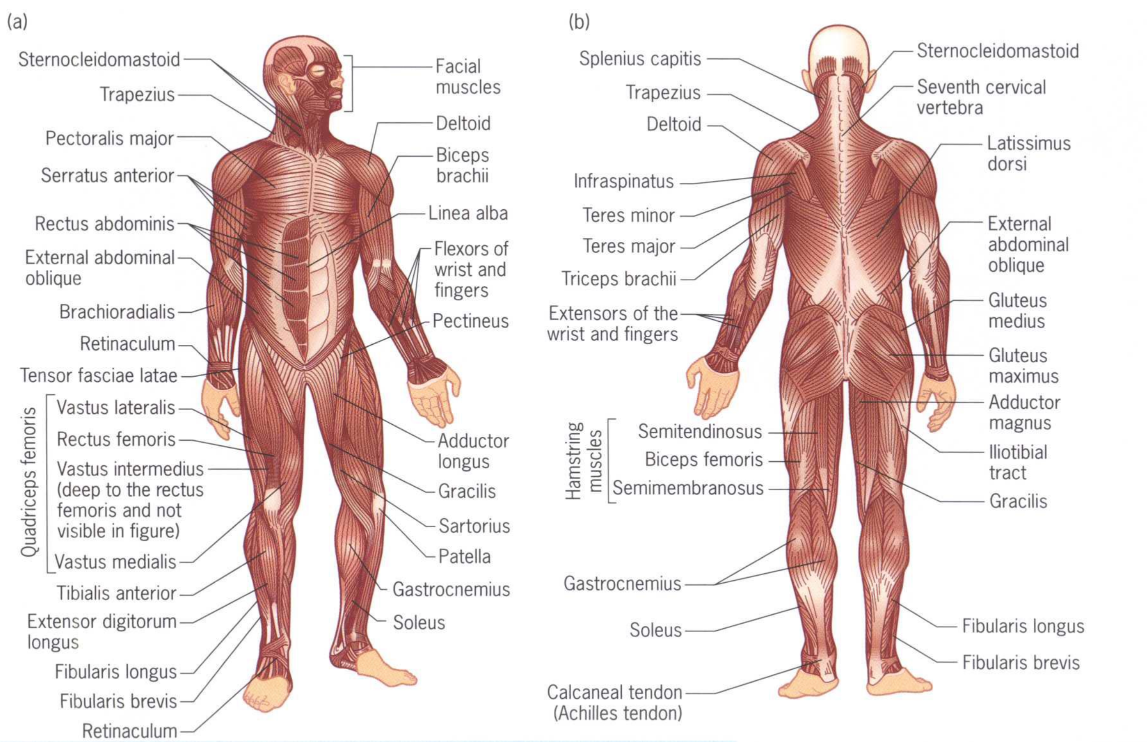
1.10 Major muscles of the upper limb **(a)** anterior view **(b)** posterior view



1.11 Major muscles of the upper arm



1.12 Major muscles of the lower arm and wrist **(a)** posterior view **(b)** anterior view



1.13 Superficial muscles of the human body **(a)** anterior view **(b)** posterior view

此为试读，需要完整PDF请访问： www.ertongbook.com