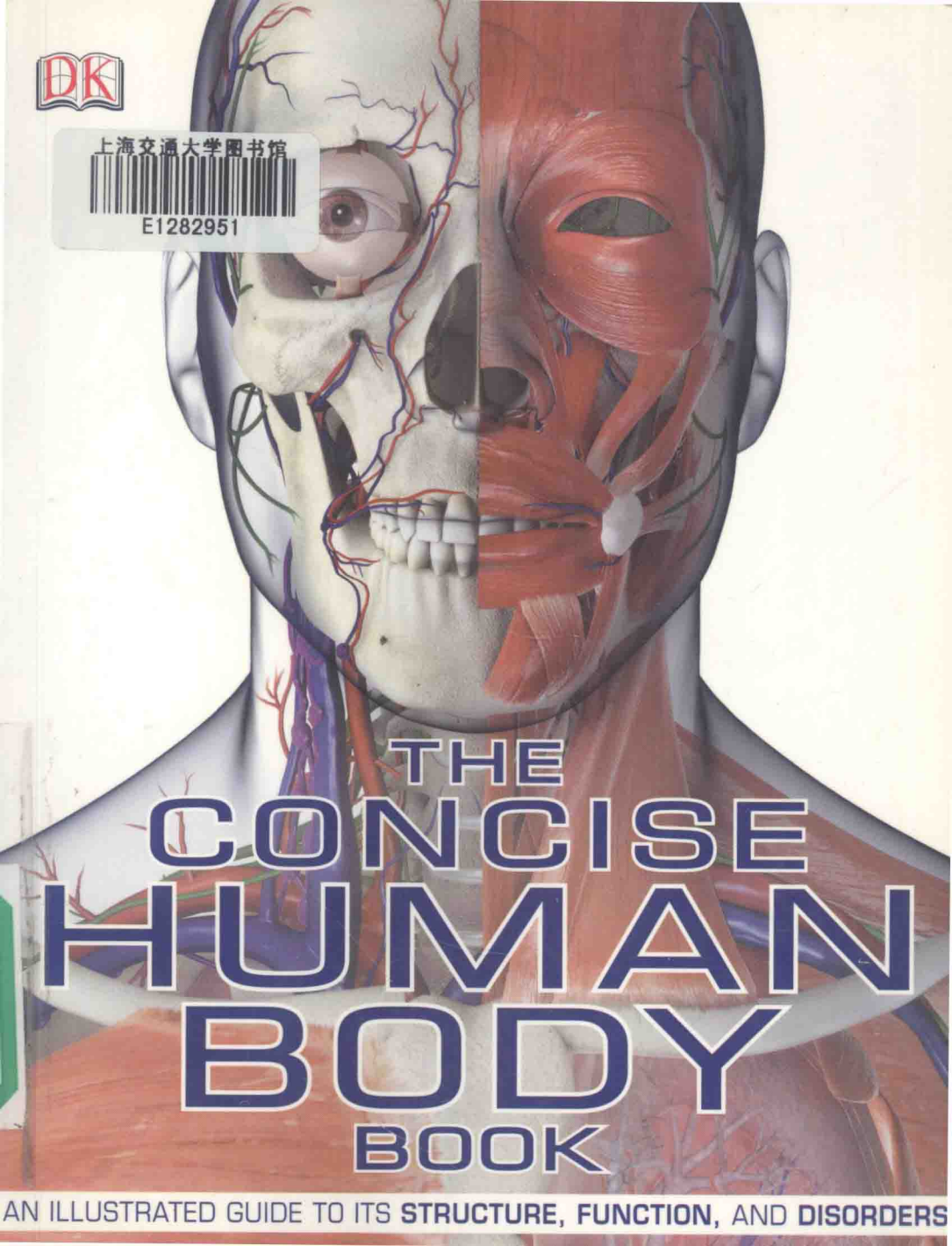


THE CONCISE HUMAN BODY BOOK

AN ILLUSTRATED GUIDE TO ITS **STRUCTURE, FUNCTION,** AND **DISORDERS**

THE CONCISE HUMAN BODY BOOK

Reveals the complexity of the human body with remarkable clarity

Hundreds of 3-D images take you through each of the body's SYSTEMS, from the skeleton and muscles to the skin and nails

Discover how every aspect of the body FUNCTIONS – how the heart beats, how we breathe, and how the body defends itself

Find out what can go wrong, with descriptions of the ways in which common DISORDERS affect the body's systems

This book has been adapted from The Human Body Book, published by Dorling Kindersley

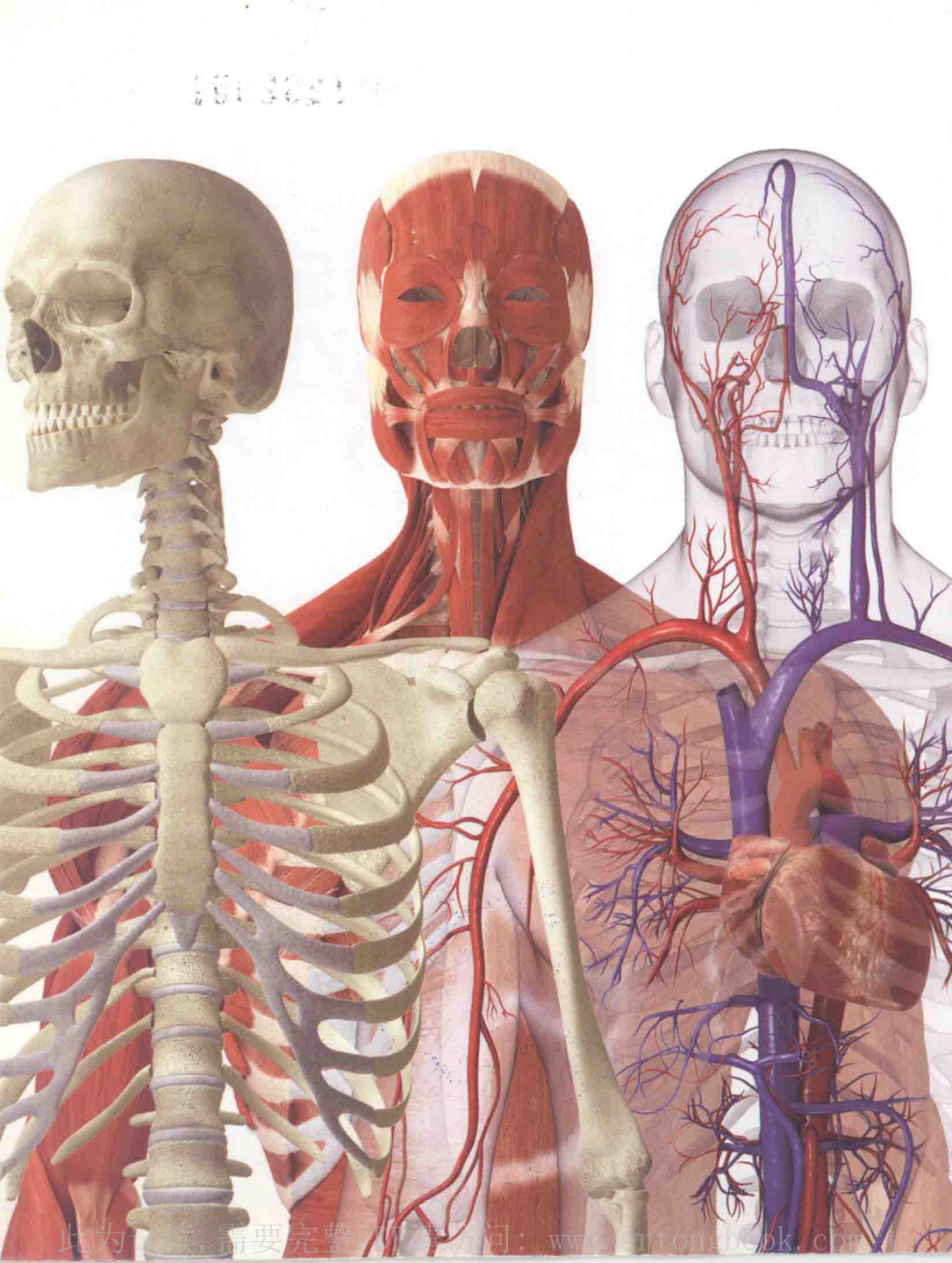
ISBN 978-1-4053-4041-0

Discover more at
www.dk.com

£9.99

THE CONCISE HUMAN BODY BOOK

THE CONCISE HUMAN BODY BOOK



THE CONCISE HUMAN BODY BOOK

STEVE PARKER

LONDON • NEW YORK • MELBOURNE
MUNICH • DELHI

PROJECT EDITORS Ann Baggaley, Philip Morgan, Martyn Page
PROJECT ART EDITORS Mandy Earey, Ted Kinsey
SENIOR EDITOR Simon Tuite
SENIOR ART EDITOR Vicky Short
MANAGING EDITOR Julie Oughton
MANAGING ART EDITOR Louise Dick
ASSOCIATE PUBLISHER Liz Wheeler
PUBLISHER Jonathan Metcalf
ART DIRECTOR Bryn Walls

JACKET DESIGNER Duncan Turner
PRODUCTION EDITORS Joanna Byrne, Maria Elia
PRODUCTION CONTROLLER Sophie Argyris
INDEXER Hilary Bird
PROOFREADER Katie John

MEDICAL CONSULTANT Dr Penny Preston

The Concise Human Body Book provides information on a wide range of medical topics, and every effort has been made to ensure that the information in this book is accurate. The book is not a substitute for medical advice, however, and you are advised always to consult a doctor or other health professional on personal health matters

The Concise Human Body Book has been adapted from *The Human Body Book*, published in Great Britain in 2007 by Dorling Kindersley Limited

A Penguin Company

6 8 10 9 7
011-TD422-Jun/09

A CIP catalogue record for this book is available from the British Library

ISBN 978 1 4053 4041 0

For *The Human Body Book*:

PROJECT EDITOR Rob Houston
PROJECT ART EDITOR Maxine Lea
EDITORS Ruth O'Rourke, Rebecca Warren, Mary Allen, Kim Bryan, Tarda Davidson-Aitkins, Jane de Burgh, Salima Hirani, Miezan van Zyl
DESIGNERS Matt Schofield, Kenny Grant, Francis Wong, Anna Plucinska
MANAGING EDITOR Sarah Larter
MANAGING ART EDITOR Philip Ormerod
PUBLISHING MANAGER Liz Wheeler
REFERENCE PUBLISHER Jonathan Metcalf
ART DIRECTOR Bryn Walls

PICTURE RESEARCHER Louise Thomas
JACKET DESIGNER Lee Ellwood
DTP DESIGNER Laragh Kedwell
PRODUCTION CONTROLLER Tony Phipps
EDITORIAL ASSISTANTS Tamlyn Calitz, Manisha Thakkar
INDEXER Hilary Bird
PROOFREADER Andrea Bagg

CONTRIBUTORS Mary Allen, Andrea Bagg, Jill Hamilton, Katie John, Janet Fricker, Jane de Burgh, Claire Cross
MEDICAL CONSULTANTS Dr Sue Davidson, Dr Penny Preston, Dr Ian Guinan

ILLUSTRATORS
Medi-Mation
Medical & Scientific Visualization

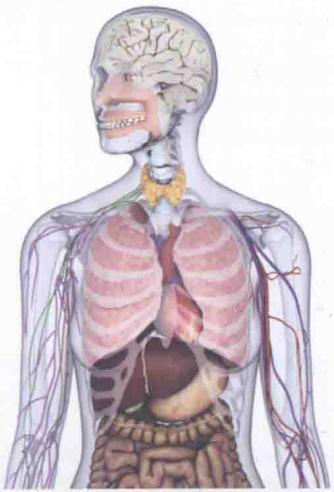
CREATIVE DIRECTOR Rajeev Doshi
3D ARTISTS Olaf Louwinger, Gavin Whelan, Monica Taddei

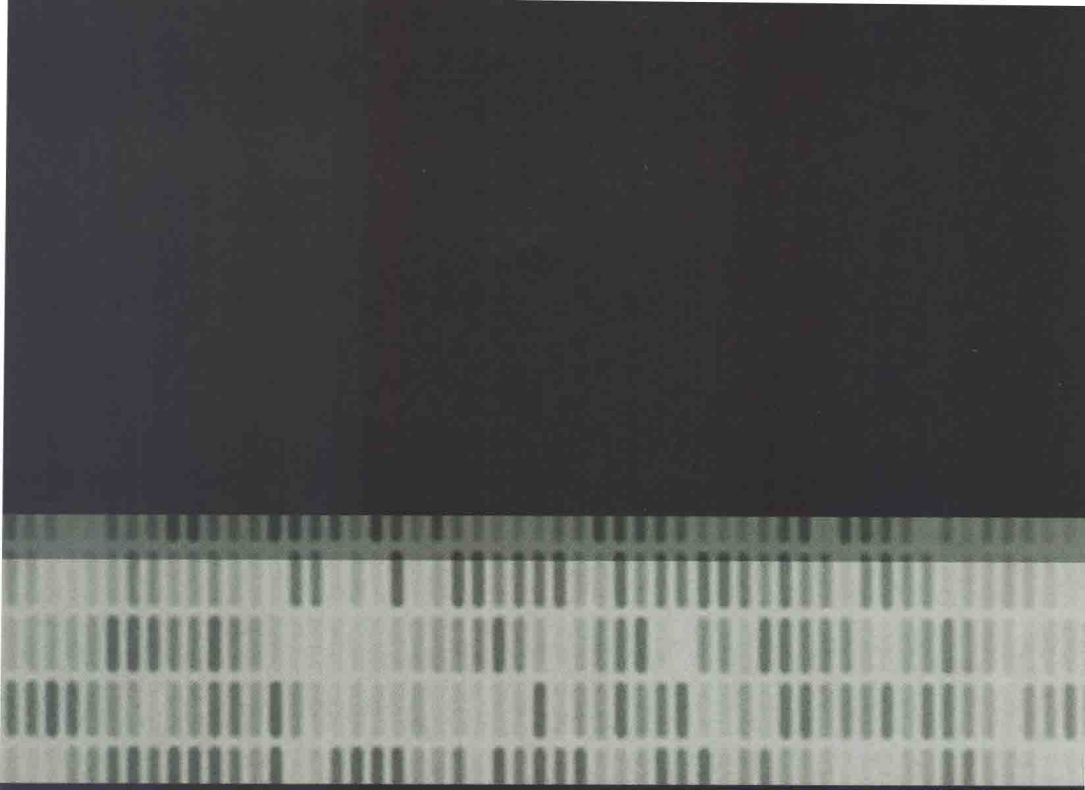
ADDITIONAL ILLUSTRATORS Peter Bull Art Studio, Kevin Jones Associates, Adam Howard

Colour reproduction by GRB Editrice s.r.l. in London, UK
Printed and bound in China by Hung Hing Offset Printing Company Ltd.

Discover more at
www.dk.com

CONTENTS





THE HUMAN BODY IS THE MOST DEEPLY STUDIED AND FREQUENTLY PORTRAYED OBJECT IN HISTORY. DESPITE ITS FAMILIARITY, IT IS ETERNALLY ABSORBING AND FASCINATING. THE PAGES OF THIS BOOK REVEAL, IN AMAZING VISUAL DETAIL, AND IN BOTH HEALTH AND SICKNESS, THE INTRICATE INNERMOST WORKINGS OF THE BODY'S CELLS, TISSUES, ORGANS, AND SYSTEMS. MUCH OF THE FASCINATION LIES IN THE WAY THESE PARTS INTERACT AND INTEGRATE AS EACH RELIES ON THE OTHERS TO FUNCTION AND SURVIVE.

INTEGRATED BODY

INTRODUCTION

The number of humans in the world is approaching seven billion (7,000,000,000). More than 250 babies are born every minute, while 150,000 people die daily, with the population increasing by almost three humans per second. Each of these people lives and thinks with, and within, that most complex and marvellous of possessions – a human body.

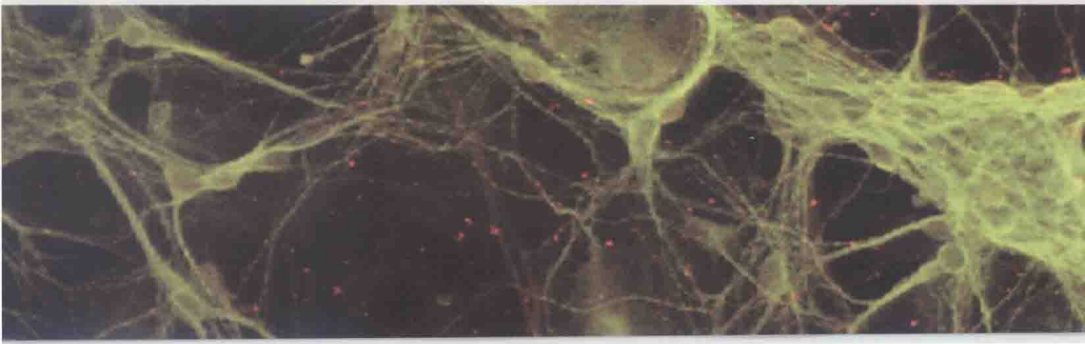
LEVELS OF ORGANIZATION

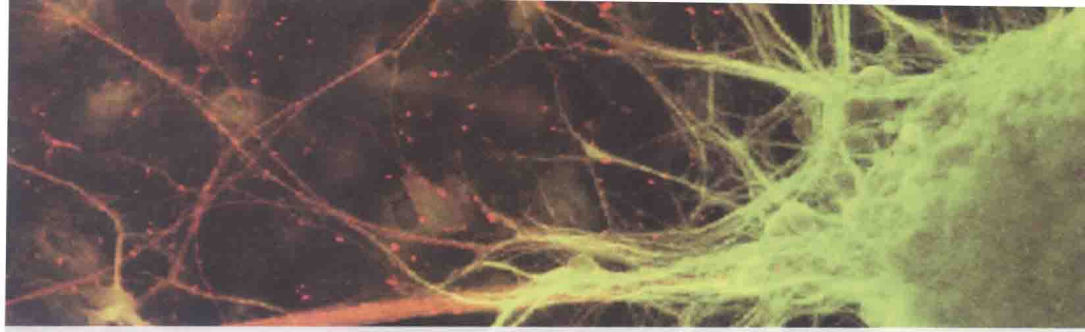
To understand the inner structure and workings of the human body, this book takes the "living machine" approach, borrowed from sciences such as engineering. This views the body as a series of integrated systems. Each system carries out one major task. In the cardiovascular system, for example, the heart pumps blood through vessels, to supply every body part with essential oxygen and nutrients. The systems are, in turn, composed of main parts known as organs. For example, the stomach, intestines, and liver are organs of the digestive system. Moving down through the anatomical hierarchy, organs consist of tissues, and tissues are made up of cells.

Cells are often called the building blocks of the body. Active and dynamic, they continually grow and specialize, function, die, and replenish themselves, by the millions every second. The whole body contains about 100 million million cells, of at least 200 different kinds. Science is increasingly able to delve deeper than cells, to the organelles within them, and onwards, to the ultimate components of ordinary matter – molecules and atoms.

ANATOMY

The study of the body's structure, and how its cells, tissues, and organs are assembled, is known as human anatomy. For clarity, its elements are often shown in isolation, because the inside of the body is





a crowded place. Tissues and organs press against one another. Body parts shift continually as we move, breathe, pump blood, and digest food. For example, swallowed food does not simply fall down the gullet into the stomach; it is forced down by waves of muscular contraction.

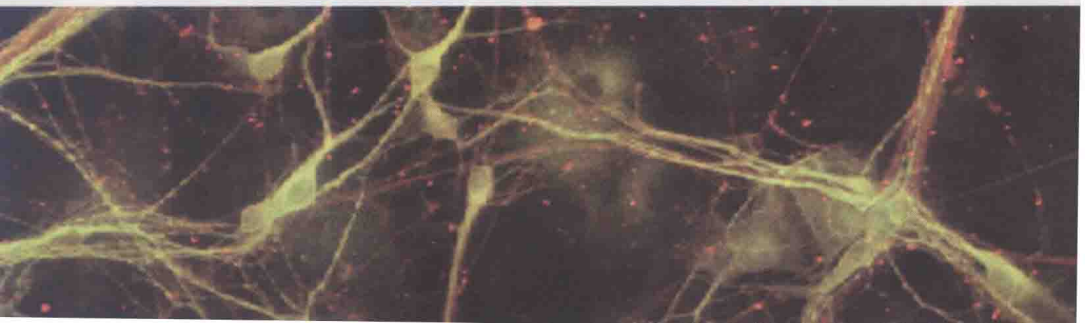
PHYSIOLOGY

For a rounded understanding of the body, we need to see human anatomy in combination with physiology – the study of how the body functions. Physiology focuses on the dynamic chemical minutiae at atomic, ionic, and molecular levels. It investigates the workings of such processes as enzyme action, hormone stimulation, DNA synthesis, and how the body stores and uses energy from food. As researchers look closer, and unravel more biochemical pathways, more physiological secrets are unlocked. Much of this research work is aimed at preventing or treating disease.

HEALTH AND ILLNESS

Medical science amasses mountains of evidence every year for the best ways to stay healthy. At present, an individual's genetic inheritance, which is a matter of chance, is the given starting point for maintaining health and wellbeing. In coming years, treatments such as gene therapy could remove or negate some of these chance elements. Many aspects of upbringing have a major impact on health, including factors such as diet and whether it is too rich or too poor. The body can also be affected by many different types of disorder, such as infection by a virus or bacteria, injury, inherited faulty genes, or exposure to toxins in the environment.

COMMUNICATION NETWORK
This microscopic image of nerve cells (neurons) shows the fibres that connect the cell bodies. Neurons transmit electrical signals around the body; each one links with hundreds of others, forming a dense web.



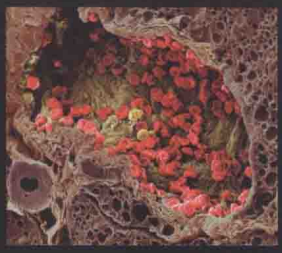
IMAGING THE BODY

IMAGING IS A VITAL PART OF DIAGNOSING ILLNESS, UNDERSTANDING DISEASE, AND EVALUATING TREATMENTS. MODERN TECHNIQUES PROVIDING HIGHLY DETAILED INFORMATION HAVE LARGELY REPLACED SURGERY AS A METHOD OF INVESTIGATION.

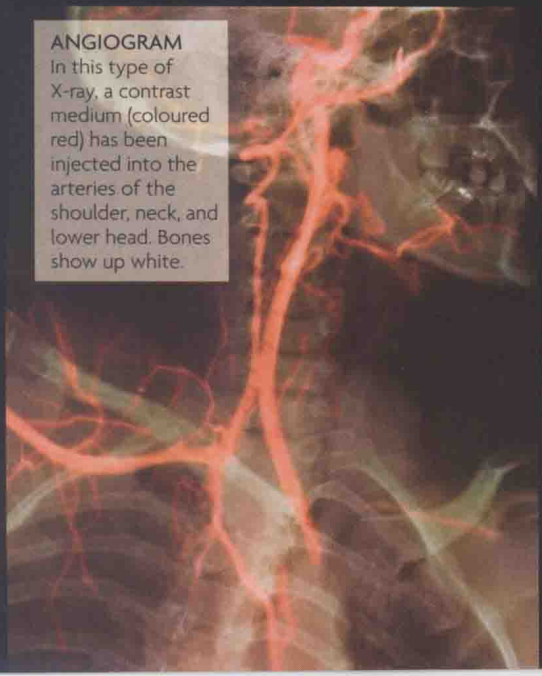
The invention of the X-ray made the development of non-invasive medicine possible. Without the ability to see inside the body, many disorders could be found only after major surgery. Computerized imaging now helps doctors make early diagnoses, often greatly increasing the chances of recovery. Computers process and enhance raw data, for example re-interpreting shades of grey from an X-ray or scan into colours. However, sometimes direct observation is essential. Viewing techniques have also become less invasive with the development of instruments such as the endoscope (see opposite). This book makes extensive use of internal images from real bodies.

MICROSCOPY

In light microscopy (LM), light is passed through a section of material and lenses magnify the view up to 2,000 times. Even higher magnifications are possible with scanning electron microscopy (SEM), in which light runs across a specimen coated with gold film. Electrons bounce off the surface, creating a three-dimensional image.



SEM OF TUMOUR BLOOD SUPPLY
This image, in which the specimen has been frozen and split open, shows a blood vessel with blood cells growing into a melanoma (skin tumour).



ANGIOGRAM
In this type of X-ray, a contrast medium (coloured red) has been injected into the arteries of the shoulder, neck, and lower head. Bones show up white.

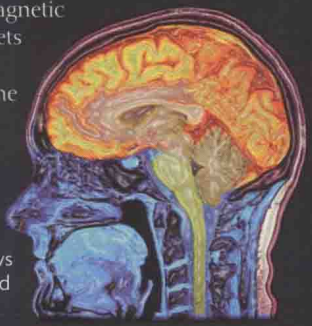
X-RAY

X-rays are similar to light waves, but of very short wavelength. When passed through the body they create shadow images on photographic film. Dense structures such as bone show up white; soft tissues appear as shades of grey. To show up hollow or fluid-filled structures, these are filled with a substance that absorbs X-rays (a contrast medium).

PLAIN X-RAY OF FOOT
A plain X-ray is especially useful for viewing dense tissue, such as bone. This image shows the foot bones of a nine-year-old child.

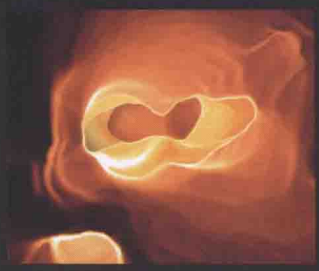
MRI AND CT SCANNING

In computerized tomography (CT) an X-ray scanner is used with a computer to build up cross-sectional images of tissues of different density. In magnetic resonance imaging (MRI), magnets are used to line up atoms in the body, then radio waves throw the atoms out of alignment. As they realign, the atoms emit signals that are used to create an image.



MRI SCAN OF HEAD

This digitally enhanced MRI scan shows the brain and spinal cord in orange and yellow, and muscle and bone in blue.

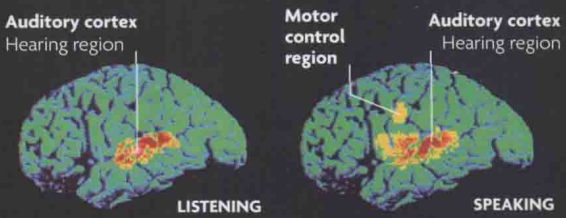


ARTERY SCAN

The layered images produced by a CT scan can be built into a three-dimensional image on a computer. The inside of a narrowed artery is seen here.

RADIONUCLIDE AND PET SCANNING

In radionuclide imaging, a radioactive chemical is injected into the body and is absorbed by the tissues. As the substance decays it emits gamma rays, which a computer forms into an image. Positron emission tomography (PET) is a type of radionuclide scanning that uses injected chemicals which emit radioactive particles called positrons.



PET SCAN

PET scans show function rather than anatomy. These images reveal the brain's activity as the subject listened to spoken words and then both listened to and repeated the words.

ULTRASOUND

High-frequency sound waves emitted by a device called a transducer pass into the body and echo back as electrical signals. A computer processes the signals to create images.

FETAL ULTRASOUND

Ultrasound is a very safe technique, commonly used to monitor fetal development in the uterus.

ENDOSCOPY

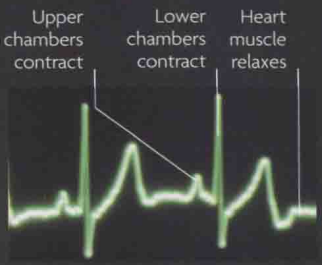
Endoscopes are flexible or rigid tubes inserted into the body to view its interior, perform surgical procedures, or both. They carry a light source and instruments may be passed down them.

TRACHEA

An endoscopic view of the trachea (windpipe) shows the hoops of cartilage that maintain its shape.

ELECTRICAL ACTIVITY

Sensor pads applied to the skin detect electrical activity in muscles and nerves. The signals are displayed as a trace line. This technique includes electrocardiography (ECG) of the heart (see below).



BODY SYSTEMS

THE HUMAN BODY'S SYSTEMS WORK TOGETHER AS A TRUE COOPERATIVE. EACH SYSTEM FULFILS ITS OWN VITAL FUNCTION, BUT ALL WORK TOGETHER TO MAINTAIN THE HEALTH AND EFFICIENCY OF THE BODY AS A WHOLE.

The exact number and extent of the body's systems is debated – the muscles, bones, and joints are sometimes combined as the musculoskeletal system, for instance. Although these systems can be described as separate entities, each depends on all of the others for physical and physiological support. Most systems have some "general" body tissues, such as the connective tissues, which delineate, support, and cushion many organs. All the systems – except, and somewhat ironically, the reproductive system – are essential for our basic survival.

SKELETAL

EXPLORED ON PAGES 38–61

The skeleton is a solid framework that supports the body. Its bones work as levers and anchor plates to allow for movement. Bones also have a role in other body systems – blood cells develop in their fatty inner tissue (red marrow), for example. The body draws from mineral stores in bones during times of shortage, such as when calcium is needed for healthy nerve function.

MUSCULAR

EXPLORED ON PAGES 62–75

Muscles work in conjunction with the skeleton, providing the pulling force for varying degrees of movement, from powerful to finely tuned. Involuntary muscles work largely automatically to control internal processes, such as blood distribution and digestion. Muscles rely on nerves to control them and blood to keep them supplied with oxygen and energy.