

## NOTICE OF NEW PUBLICATION FOR CLINICAL ENGINEERING

On 31 January, 2009 a brand new publication will be released for all Clinical Engineering Practitioners

Title of the publication: *Human Bio-Systems for Clinical Engineering Practitioners*

Authors: JD van Roon (Pr. Techn., M Dip Tech, NTD, MCEASA)  
and MM van Roon (Nursing Dipl, Reg. SA Nursing Council).

The publication is written as a reference source for all persons in the field of Clinical Engineering. **It also satisfies the requirements of the subject, Bio-Systems 1, for the national electrical engineering diploma (clinical engineering option)** and, for those professionals serving the auxiliary medical services!

Edition date: first edition 2009, ISBN: 978-0-620-42023-5  
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Price : R 250 including postage, pay upfront.

Book may be ordered directly only on COD basis from the author:

Tel. 044 870 7706 or

Email: [johanr1@vodamail.co.za](mailto:johanr1@vodamail.co.za)

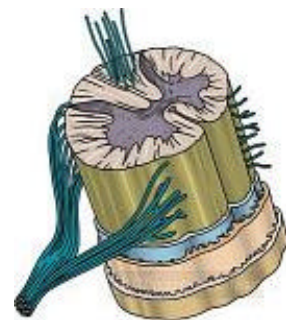
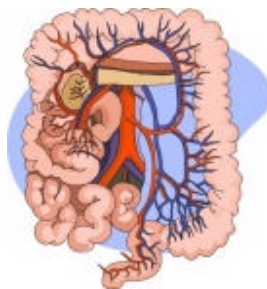
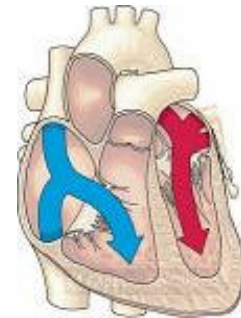
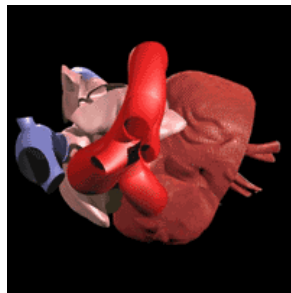
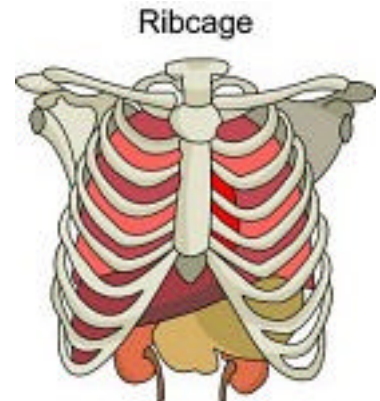
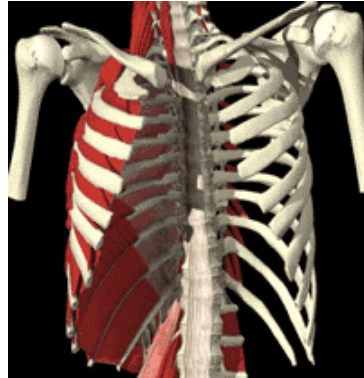
Snail mail: 13 Wattle Road, Heatherpark, George, 6529, South Africa.

A view of the front page is shown on the next page



# Human Bio-Systems for Clinical Engineering Practitioners.

by JD and MM van Roon



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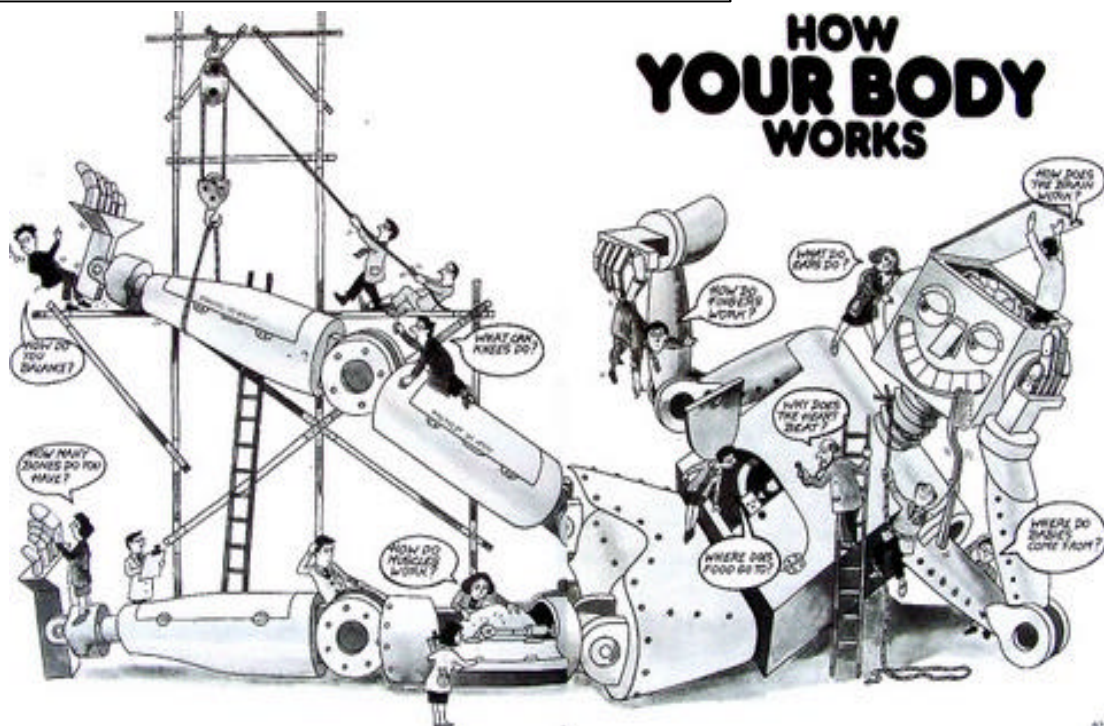
## Foreword and Introduction

As you make your way through this book, you will be learning about one of the most fascinating subjects possible.....your own body.

Such a study is not only highly personal, but timely as well. The current information blizzard brings news of some medical advances almost daily. If you are to appreciate clinical engineering you need to understand emerging discoveries in human biology, and to learn about the workings of your body so as to understand new techniques and applications in the health technology. For those preparing for a career in clinical engineering, the study of anatomy and physiology has added rewards because it provides the foundation needed to support your specific field of study, and the support it gives to healthcare of the patient.

In engineering we try to copy the unique human body functions in a ROBOT. It was found to be very difficult to simulate them. It is more noticeable in the picture below where a humoristic picture indicates this.

A FUNNY ENGINEERING APPROACH TO THE HUMAN BODY



Human Bio-Systems for Clinical Engineering Practitioners,  
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# CHAPTER 1

## INTRODUCTION TO ANATOMY AND PHYSIOLOGY

### Definition of Anatomy and Physiology

*Anatomy* studies the *structure* of body parts and their relationships to one another. Anatomy has a certain appeal because it is concrete. Body structures can be seen, felt, and examined closely; it is not necessary to imagine what they look like.

*Physiology* concerns the *function* of the body, in other words; how the body parts work and carry out their life-sustaining activities.

### 1.1 How Is The Body Organised

The human body has many levels of structural organisation as can be seen in Chap1-figure 1. The organisation will be discussed from the simplest level to the more complex level.

The *simplest* level of the structural hierarchy is the **chemical level**. At this level, *atoms* combine to form *molecules* such as water and proteins. Molecules, in turn, associate in specific ways to form *organelles*, this is the basic components of the microscopic cells.

**Cells** are defined as the smallest units of living things. The **cellular level** is examined in *paragraph 1.2*. All cells have some common functions, but individual cells vary widely in size and shape, reflecting their unique functions in the body.

From high school biology we have learnt that the simplest living creatures are composed of single cells, but in complex organisms such as human beings, the hierarchy continues on to the **tissue level**.

*Tissues* are groups of similar cells that have a common function.

The **four basic tissue types** in the human body are epithelium, muscle, connective tissue, and nervous tissue. Each tissue type has a characteristic role in the body. Briefly, epithelium covers the body surface and lines its cavities; muscle provides movement, connective tissue supports and protects body organs; and nervous tissue provides a means of rapid internal communication by transmitting electrical impulses.

**Definition:** An **organ** is a discrete structure composed of at least two tissue types (four is more common) that performs a specific function for the body.

At the **organ** level, extremely complex functions become possible. Let's take the stomach for an example. Its lining is an epithelium that produces digestive juices; the bulk of its wall is muscle, which churns and mixes stomach contents (food); its connective tissue reinforces the soft muscular walls, and its nerve fibres increase digestive activity by stimulating the muscle to contract more vigorously and the glands to secrete more digestive juices. The liver, the brain, and a blood vessel are very different from the stomach, but they are organs as well. It is best to think of each organ of the body as a specialized functional centre responsible for a necessary activity that no other organ can perform.

The next level of organization is the **organ** system. Organs that work together to accomplish a common purpose make up an *organ system*. For example, the heart and blood vessels of the cardio vascular system see to it that blood circulates continuously to carry oxygen and nutrients to all body cells. Besides the cardiovascular system, the other organ systems of the body are the *integumentary, skeletal, muscular, nervous, endocrine, lymphatic, respiratory, digestive, urinary, and reproductive systems*.

**See sketch: Chap1-figure 1: Different level of the organisational structure of the human body and Chap1-figure 2: Interrelationships among the different body organ systems and the external environment**

Lastly the highest level of organization is the *organism*, the living human being.

The **organismal level represents the sum total of all structural levels** working together to promote life.

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