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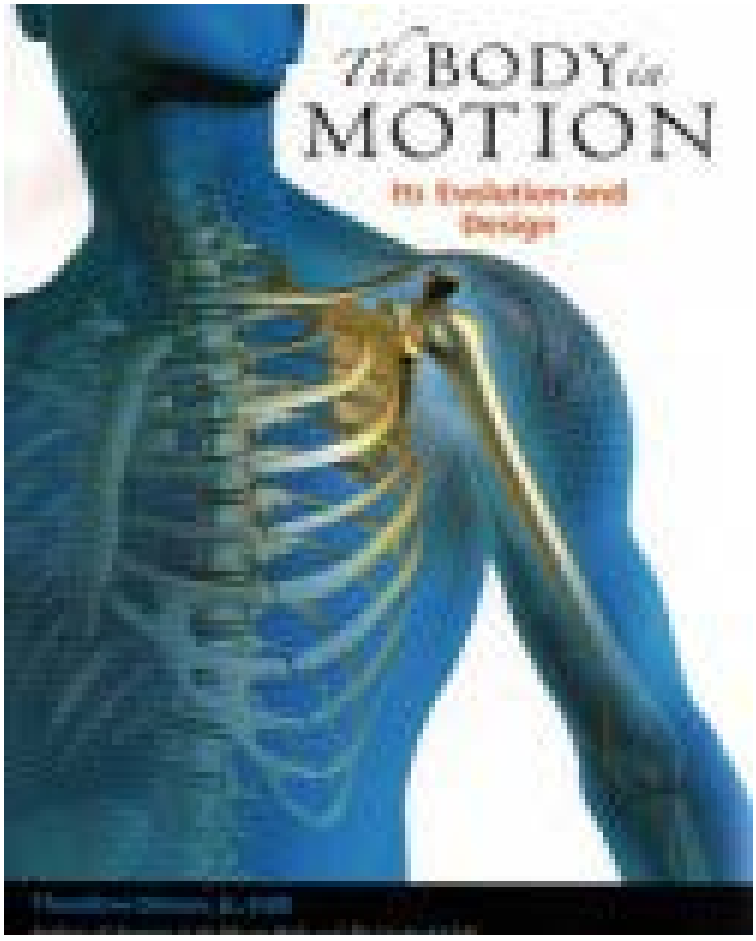
The Body in Motion



The Body in Motion

Its Evolution and Design

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12. The Spiral Musculature

13. The Miracle of the Human Form

Preface

The Body in Motion: Its Evolution and Design is based on a series of lectures presented at the Dimon Institute from 1996–2005. Its purpose is to provide a comprehensive look at our wonderful and unique anatomical design. An earlier series of lectures, published as *Anatomy of the Moving Body* (North Atlantic Books, 2001), provided a basic introduction to musculoskeletal anatomy—a working vocabulary of the muscles, bones, and joints that make up the human body. *The Body in Motion* delves more deeply into the subject of how these pieces function as a working whole.

This book is written for students and professionals interested in human movement—educators, bodywork practitioners, physical therapists, medical clinicians, actors, dancers, and anyone interested in understanding anatomy from the perspective of how we're designed to move and function.

There are a number of people who have helped, directly and indirectly, in the making of this book. First I would like to thank Seymour Simmons, my friend and colleague, for his constant support and advice, and for generously allowing me to use his drawing of the Winged Victory of Samothrace at the end of the book.

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Introduction

Among the impressive array of machines which humans have invented, there is none that even remotely compares to the subtle and marvelous complexity of the human body. Our capacity for skilled movement, our upright posture, our hands, vision, and the other senses—all are marvels of engineering and design. But why do we possess this design, and how did we become this way? At first glance, many of the seemingly arbitrary details of our anatomy—the bony protrusions of the shoulder girdle, the spine, our intricate musculature—seem to defy full understanding. Yet each of these structures, when examined in terms of its functional design, proves to be uniquely suited for its particular purpose. This book will examine our anatomical design and make sense of the complex structures of the human body in the context of the specific functions they serve.

The topic of our anatomical design, as will become clear in the following pages, falls into two categories. The first deals with specific bodily systems such as the hand and shoulder girdle. Perhaps because so much of what we know about the shoulder girdle and hand is derived from dissections of the human body and detailed studies of its movement, anatomy books—even ones that specialize in movement—tend to focus on technical and quantitative descriptions of muscles, bones, and joints that are often obscure and difficult to understand. Because the subject seems inherently technical, it seems that unless we learn all these details, we'll never really understand how the different parts of the body work.

But such technical descriptions do not do justice to the reality of how these remarkable structures actually work. In simple terms, the shoulder girdle is basically a shallow socket that supports the levers of the upper arm. Because the arms in humans have become adapted for manipulation, this socket is highly movable so that the arm can have as broad a range of motion as possible. Once we understand this, many of the features of the shoulder girdle, such as the shape of the scapula, the function of the clavicle, and the movements we can make at the shoulder, become easy to understand. The hand is also quite complex, but when we look in simple terms at how it works and how the thumb is designed to oppose the fingers, many of the details we thought were important become unnecessary, and the entire thing makes sense in a way we didn't think possible. In this book, we'll look at the various systems in the body and, by understanding what they do in common sense terms, make sense of their anatomical design and their specific parts.

Another factor which tends to complicate the subject of anatomy is the use of language. Because it is based on scientific and technical terminology, anatomy seems to represent a specialized body of knowledge available only to those who have been initiated into this subject by virtue of their scientific background. But most anatomical terms are simply descriptive names given by the Romans and Greeks to parts of the body they needed to identify. When we get behind this language, we demystify the subject and see muscles, bones, and joints for what they are: parts of a complex machine that do things and make

sense in the context of what they do. In the following pages, we'll avoid technical language as much as possible, looking instead at how things work and then naming the various parts afterward.

The second theme of this book focuses on our overall design. Exercise and bodywork systems often speak in general terms about muscle groups that need strengthening, larger muscle systems and lines of force, and different ways of training or releasing muscles—all giving the impression of a general framework for how the body works. But most of these systems have been developed by dancers, trainers, or massage therapists who are trying to train the body to look better or get stronger by strengthening or releasing muscle groups; they are not based on a real knowledge or study of how the musculoskeletal system is actually designed to work as a total system in activity. The human body is capable of an amazing array of activities. We can walk on two feet and perform a vast repertoire of movements; by coordinating dozens of muscles throughout the body, we create and form the sounds of speech; using our finely controlled and sensitive hands, we're able to master skills of incredible subtlety and complexity. Yet none of these actions would be possible if we had not evolved our distinctively human upright posture. In order for us to be able to use our hands or control our voices with the required precision, evolution had to work out an elegant upright support system that enables us to perform specific actions and skills—when it works as it's designed to work—with effortless efficiency.

This larger upright system is the basic system on which all the other systems—such as breathing and voice—depend. We can perform breathing exercises to make specific improvements, but unless we understand the total design on which breathing is based, we are working at a huge disadvantage, since this larger design is the single most important factor influencing breathing. The same is true of the health and functioning of specific muscle groups such as the lower back. Various methods promise to elongate, strengthen, and release the back muscles by employing exercises or stretching methods. But the back muscles are inextricably linked with our upright posture, and the only way these muscles can function properly is in the context of this larger system. Even awareness exercises, which tend to make us feel more relaxed and balanced because they are more holistic in approach, cannot be effective if they are not based on a positive concept of how the body is designed to work. A true practice of awareness must be based not on movement or relaxation but on a genuine understanding of how the musculoskeletal system is actually designed to work in activity.

This is not to say that therapeutic methods or awareness practices are completely invalid. Many situations warrant physical therapy, stretching, and treatment. But such systems can't substitute for a working knowledge of how the body is designed to function as a total system in action. When it comes to musculoskeletal functioning, the most important anatomical knowledge we can possess is an understanding of how the body is designed to operate in action based on its total functional design. In this book, we'll look in detail

at how the body works as a total system, understand how specific systems relate to this general system, and examine how the body is designed to work as a coordinated whole based on this larger design.

In an even broader sense, our upright design is not just about movement but is directly linked to our higher faculties. The human body is the most versatile moving machine one can imagine. It is capable of producing a greater range of activities, with greater precision, than that of any animal on the planet. To control all these movements, we have evolved that most sophisticated of organs, the human brain, which manages an enormously complex set of functions with remarkable efficiency. Our highly evolved brain, however, is directly linked to our upright design, without which we could not have developed speech or the use of the hands. The musculoskeletal system is indeed a remarkable moving machine, but viewing muscles and bones in purely mechanical terms hardly begins to do justice to the range and beauty of our anatomical design. It is not an overstatement to say that the human body is the vehicle of the soul, for without it, none of our singular human achievements—not even those that are considered purely intellectual or abstract—would be possible. The hand, for instance, is not simply a system of levers that makes it possible to grasp and manipulate objects, nor is it merely a sensory organ; it is in fact the instrument which makes possible many of our greatest technological and artistic achievements. It allows us to explore our world, to fashion instruments, to touch a loved one, and to create works of art. It is, to put it simply, an extension of the brain, without which the brain as we know it could not have evolved. The muscles that support upright posture, our shoulders, limbs, and voice—all are tangible aspects of our higher selves. To understand our physical design is to understand the underpinnings of our intellectual, social, and artistic lives.

1. The Origins of Movement

One of our most distinctive human attributes—and the one that most concerns those of us who are attempting to make sense of our musculoskeletal design—is movement. Like many other vertebrates, we are capable of moving in very complex and sophisticated ways. Vertebrates move by contracting muscles which are attached to bones. The bones form joints with other bones and therefore act as levers; the muscles are motors which move the levers. Some animals can swim underwater, some can run at high speed, and still others can fly. Because we are balanced up on two feet, we are capable of an unusual range of movements, such as the ability to walk and run, to twist and rotate our bodies, to use our arms and hands in various ways, and to produce speech. But all vertebrates, in one way or another, possess the ability to produce movement by contracting muscles which move bones.

Bones, Muscles, and Movement

When we observe the complexity of the human musculoskeletal design, it is difficult to fathom how bones and muscles originated, and why they are so intricately arranged. But this complex system of bony levers and muscles evolved in a definite way and for definite reasons. If you observe a fish swimming, it is easy to see that it mainly uses its muscles and bones to propel itself through the water by levering its flexible spine and tail from side to side. Apart from action of the fins and jaw, a fish doesn't have any other movement options because it lacks other bones and thus other means of hinging or moving parts of its body (Fig. 1-1).

Figure 1-1. A primitive fish (amphioxus).

Index