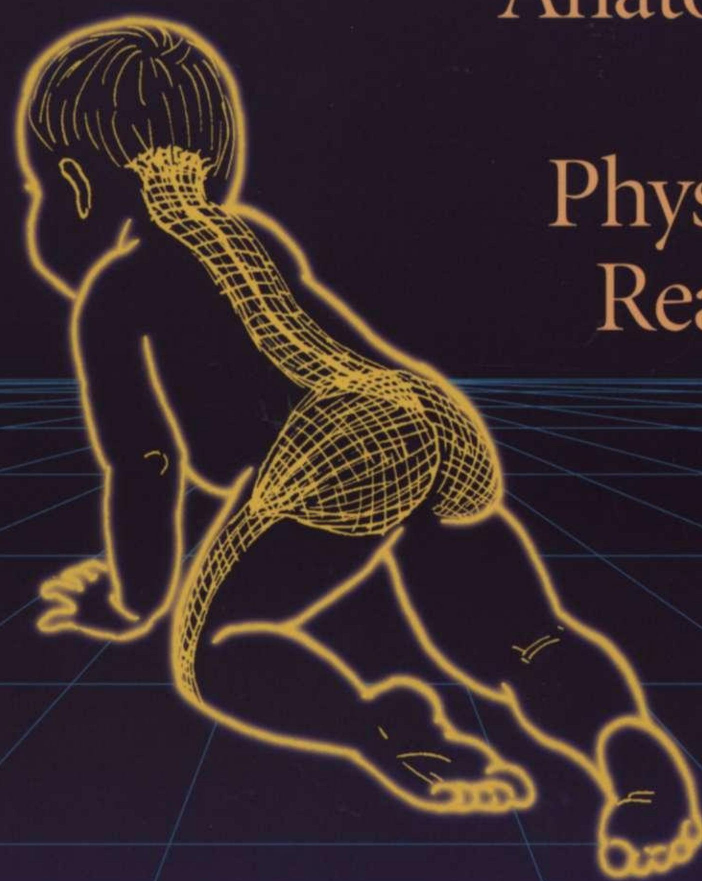
THE ENDLESS WEB

Fascial Anatomy and Physical Reality



R. Louis Schultz, PhD
Rosemary Feitis, DO

Health/Bodywork

The result of more than two decades of research and practice, *The Endless Web* presents in clear, readable language a comprehensive guide to understanding and working effectively with the myofascial system, the "packing material" of the body. Myofascia is a flexible network of tissue that surrounds, cushions, and supports muscles, bones, and organs. It also acts as a riverbed containing the flow of interstitial fluid, and is a critical influence on the immune and hormonal systems. In daily life, this connective tissue is an underlying determinant of movement quality, mood, alertness, and general well-being. *The Endless Web* is a fully illustrated guide to understanding how myofascia works, its supportive role within the body's anatomy, and how gentle manipulation of the myofascial tissue is central to lasting therapeutic intervention and how it can be integrated into any bodywork practice.

R. Louis Schultz has been a Rolfer since 1973, and is currently on the Anatomy Faculty of the Rolf Institute in New York City. He has authored numerous scientific articles and is co-editor with Rosemary Feitis of *Remembering Ida Rolf* (North Atlantic Books, 1996).

Rosemary Feitis worked with Dr. Rolf on her groundbreaking book *Rolfing,* edited *Rolfing and Physical Reality,* and is co-editor of *Remembering Ida Rolf*. She practices Rolfing and homeopathy and lives in New York City.

Illustrator Diana Salles is senior artist at the Museum of Natural History, New York.

Photographer Ronald Thompson has been a Rolfer for twenty-five years and is a member of the Anatomy Faculty of the Rolf Institute.

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R. Louis Schultz, Ph.D. and Rosemary Feitis, D.O.
Illustrations by Diana Salles
Photographs by Ronald Thompson

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Dedicated to Ida P. Rolf

A promise fulfilled—with love

Our thanks go to Sean Hellier
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the physical book would not exist

Contents

Introduction

The muscle-bone concept presented in standard anatomical description gives a purely mechanical model of movement. It separates movement into discrete functions, failing to give a picture of the seamless integration seen in a living body. When one part moves, the body as a whole responds. Functionally, the only tissue that can mediate such responsiveness is the connective tissue. This is the heart of the concept that we are proposing in this book. Including an understanding of fascia/connective tissue in the evaluation of movement gives an more accurate picture of the physical reality of the body.

The connective tissue concept we discuss accounts for much of the success of Rolfing. This is a concept that was original and unique with Dr. Rolf at the time she was developing her method of working with bodies. She started in the late 1930s. At that time and up into the 1950s, received wisdom stated that soft tissue could not hold a change. Myofascia per se was not even considered as a determinant of structure. Bone-setting (osteopathy, chiropractic) was the only treatment for structure that was then considered effective. Today, many forms of bodywork include a soft tissue technique.

This is one of the two ideas about bodywork that Dr. Rolf established through her work. Her other seminal idea has to do with the concept of gravity as it acts on the physical body—the stress lines through the body that ideally establish and reinforce physical structure. This, too, is implemented through the connective tissue component. In fact, the centrality of connective tissue to Rolfing and our attempt to understand connective tissue has been the impetus for this book.

The way bodies change during Rolfing is not satisfactorily explained by any of the usual descriptions of physical makeup. Traditional anatomical attitudes about connective tissue do not give us a living picture of the dynamics involved in the changes we see in our work. What has interested us is the body's apparently great capacity for structural change at any age. We are confronted daily with very wide deviations from standard anatomical description in people who function perfectly well. People look very different even though they are made of the same component parts. We have come to the working hypothesis that this variability is a function of certain properties of the connective tissue best illustrated by its development from embryonic mesoderm into mature tissue. Our ideas and concepts have come directly out of our experience as Rolfers—a combined total of more than forty-five years.

People tend to approve and disapprove of their bodies piecemeal. It's rare for them to look at themselves and say they're all bad or all good. Rather, it's "My belly sticks out," "I've always had knock knees," "My left foot is bigger than my right foot." On those occasions when they are feeling good about themselves, they like the shape of their head or the set of their shoulders. Women say they look good in those shoes, while men say, "That cut of jacket brings out the best in my shoulders."

Not only do they see themselves this way, they also have the same impression of others. For many, certain parts of the body are more attractive: "I'm a leg man," or "I like men with big shoulders." In our national culture, it seems to be accepted that one's business, economic, social, and sexual successes are less if one is fat. A man fears that if his pelvis moves when walking, running, or other kinds of movement, the whole world will question his sexual preferences. A woman's broad shoulders are taken as a sign of aggression and masculinity.

Most of inner-body awareness is also piecemeal, and generally negative: "I have an upset stomach," "My knee hurts," "My neck is stiff," "My nose is stuffed." More than likely this is a carry-over from the Puritan notion that it is unseemly to speak well of oneself. When I brag, I am conceited, which is bad. This gets internalized so that when I feel good about myself, good about my body, I end up feeling guilty.

Even when the aim is to improve the physical self, the focus is on one thing at a time. A man will do push-ups and lift weights to broaden his shoulders; a woman will do leg lifts to slim down her legs and hips. Yet those hips or those shoulders are an expression of everything else in that body. They're the result not only of its structure, but also and reciprocally of how everything else in that body is used.

This kind of connectedness is easy to understand in impact injuries. When I stub my toe, the injury resonates through my whole body, all the way to my head, whether I notice it or not. The pain in the toe makes me not want to stand on it, and my whole body shifts in order to avoid feeling weight on the painful part. I walk lightly on the side that hurts, more heavily on the side that doesn't. If I'm not aware of doing this, my tendency is to keep the shift in weight to one side long after the toe is no longer painful. The painful side has contracted away from the source of pain and is shortened. This is especially true if the toe was broken, and the pain has persisted for a long time. The compensation (shortening and deviation) becomes a permanent part of structure.

An even more obvious example is a broken arm or leg. Even after the cast is removed, there is the physical habit of allowing for the weight and bulkiness of the cast, as well as the fear of once again freely using the part that was broken. People tend to carry an arm that was once broken half bent, as though it were still in a sling or a cast.

These are straightforward responses to straightforward injuries. Our bodies tend to record our responses to the events in our life like a calculator with a memory. In our living tissue, the record becomes fixed with constant replaying. Like an orchestra, each part relates to the other segments. In an orchestra whose members have many years of experience playing together, if one section goes off key or plays off tempo, the rest of the orchestra attempts to compensate and blend in.

In the human body, compensation is life supportive. If I were to give in completely to a broken leg or a whiplashed neck, I would be in bed. I wouldn't be able to function. The body's tendency is to go toward as much balance in any given moment as it can find, giving us maximum operational support for that moment. The problem occurs when we keep the compensation after the injury has healed. One of the most common examples of this is the tendency to keep birth trauma as a part of one's physical makeup.

What has fascinated us as Rolfers in our work with clients and in our experiences of our own bodies is the mechanism of this record. How and where do we keep this memory of old injury? Ida Rolf's answer was to examine a system of the body that has been neglected, both by scientists and by medically oriented practitioners: the connective tissue or myofascia. To use the orchestra analogy, the connective tissue is the score on which the notes are written; bone, muscle, and organ systems are the instruments. The connective tissue is the record; it is an information bank for the body.

Visualize a net curtain or a hammock. When a hook pulls on one part of that web, the resulting distortion influences every part of the system to some degree. As we look at connective tissue, its highly structured directional orientation is suggestive of this kind of information system. By tracing connective tissue's origin, function, and appearance in the body, this book shows how myofascia creates an informational whole of the living organism. It is the unifying factor in the movement system we call the body. Thickening, snagging, or holding in any part of the connective tissue web results in a general heaviness of movement. What at first is a way to protect a part of the body (particularly a part that hurts) eventually results in a loss of fluidity throughout the entire body.

Perhaps the best image of fluidity is a tiger on its way through the forest, not making a sound as it moves across leaves and twigs and past bushes. Its "knee bone is connected to its . . . arm bone" without restriction, allowing a spring-like action among all parts of its body. Our dream is to have all of us moving surefootedly through our forests—be they of wood, of steel and concrete, or of humanity.

PART ONE

Early Development Pre- and Post-Birth

ONE

Embryology

Introduction to Connective Tissue

The basis for all body form is embryology. In understanding embryology, we understand how the adult structure came to be. Embryology doesn't stop at birth; we have that potential for change all along. In a sense, we are embryos throughout our lifetime. The aging process is also a part of the embryological process. Death is a normal part of development. Degeneration is a normal part of the life cycle of tissue, which grows and dies from the early months of prenatal life.

To the embryologist, the term "embryo" is applied to development through the first trimester of pregnancy. Later stages are termed "fetal development." We are generalizing the term, using embryological in a much broader sense, as a time when things develop and differentiate. All tissue goes through this state, bones as well as soft tissue. In general, this stage marks the origin of potential organs. Undifferentiated cells develop into potential liver, potential bone, potential skin. The body is always at potential—to change, and for new things to develop.

Birth is a change in environment, one of many that occurs throughout life. We know that cells turn over within organs—that is, they live, die, regenerate. This is true of every organ except the brain, and even that is beginning to be questioned. Each cell has a finite lifetime, normally considered seven years. Within seven years, every cell in an organ dies and is replaced. Theoretically that means there is a potential in these cells to regenerate in a different direction. This may be what happens in aging. In our view, all change is the first step in new possibilities. This is what we mean by developmental anatomy.

A bone can be remodeled throughout life as the relative stresses on it change. This is how braces work on the jaw (now being used for all ages): constant pressure creates some change in the bone formation and, thereby, in the contour of the upper and lower jawbones. Research has been published which describes the results of changing and increasing the pressure on one end of a bone. The bumps on bones are places where muscle tendons attach. The bumps are therefore regions of localized rapid growth of bone as a result of prolonged tension on that spot. If tension is applied to a different area, the new area is stimulated to create an increased amount of bone, another bump. What then appears to happen is that on the other side of the bone there is some localized resorption of bone, resulting in an indentation. It seems that a certain volume of bone is needed in the body; its configuration adapts to changing stresses over time. This means that if we hold ourselves in a bent position, bone ultimately accommodates its shape to that position. Under prolonged stress the bone can get a different configuration, a slightly different curving. These changes are slight, but if they were plotted over time they would nevertheless probably be measurable. We all see people become more bent with age. The bone has changed its configuration. It doesn't happen in one month or six; it takes place over many years.

Connective tissue literally connects and supports. It forms the structure of the body. This is a new concept. We tend to think of structure in terms of muscle and bone. But in fact, structure is the result of the organization of muscle and bone. Connective tissue, in response to movement, is the organizing factor. Muscle tissue is enfolded within the fascia; the combination is called myofascia. Movement is the outcome of embedded muscle tissue action on the surrounding connective tissue. ***(Fig. 1-1).*** Structure is thus the result of movement, the characteristic muscle action on the connective tissue bed as a whole. Connective tissue (myofascia) defines the body contour and is the organ of structure and movement (as Ida Rolf called it) in the body.

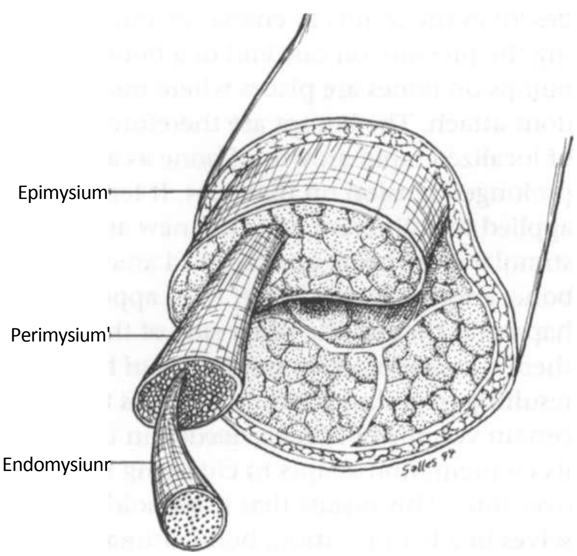


Figure 1-1
This cross section of the arm shows the way in which muscle tissue is embedded within its connective tissue wrapping.

Connective tissue supports the organ, nerve, and vascular systems. It makes up a high proportion of body mass, reaching through all body elements like a supportive net or spider web. This is a good image because it is organized but irregular—the fibers of a spider web are also not in a completely regular pattern. A spider web depends on its support—twigs or the window ledge it's spun around—for its shape. Similarly, myofascia is adaptive.

Most of the forces acting on a body are from the outside. But forces also arise from inside, in the interconnections within the body. Interconnections are maintained with movement or inhibited with lack of movement. Many people move only a part of their backs when they walk, for example. As a result, connective tissue in the back loses its elastic, spider web quality and is much less adaptable or movable. Perpetuating this immobility, connective tissue thickens and hardens.

There is research showing that pressure or tension or friction applied in one area of the embryo results in increased secretion of fibers by the connective tissue cells at the stimulated place. These fibers tend to arrange themselves along the line of the pull or friction or tension. The connective tissue then changes from a lacelike elasticity to something more dense. If a fly gets caught in a spider web, there's a snag, a tightening of the web in that area. Everything is pulled toward that snag, particularly as the fly moves around. Similarly, if there's a snag in the myofascial web, it tends to grab—connective tissue fibers concentrate there.

We have said that everything in the body is supported by connective tissue. Within that tissue is a rich network of capillary beds. When an area is compressed, the blood supply to that area is also compressed and thus impeded. This then affects the physical state of the intercellular matrix, with far-reaching results on particular stages of development.

Connective tissue is alive in the sense that it responds to stimulus. It has certain physical laws that it lives by. There are chemical laws as well, but the physical ones are more readily apparent. A given situation always gives rise to a specific reaction. Connective tissue cells (fibroblasts) build and secrete fibers. Under a certain kind of stimulus, such as pressure, this process can be speeded up. This is not unusual; it is the normal way for a tendon or ligament to grow and take shape before birth. As the embryo gets bigger, the bones get bigger. In growing, the bone pushes out, creating a directional pressure in the connective tissue bed between the two growing heads (ends) of the bone *(Fig. 1-2).* This is the normal formation of ligaments and (where there is muscle tissue) of tendons. The direction of the ligament or tendon is determined by the directional pull. The pattern of muscle and tendon and ligament is established very early, in the first couple of months of gestation. In the later months, structures become more elaborate, more set, and larger.

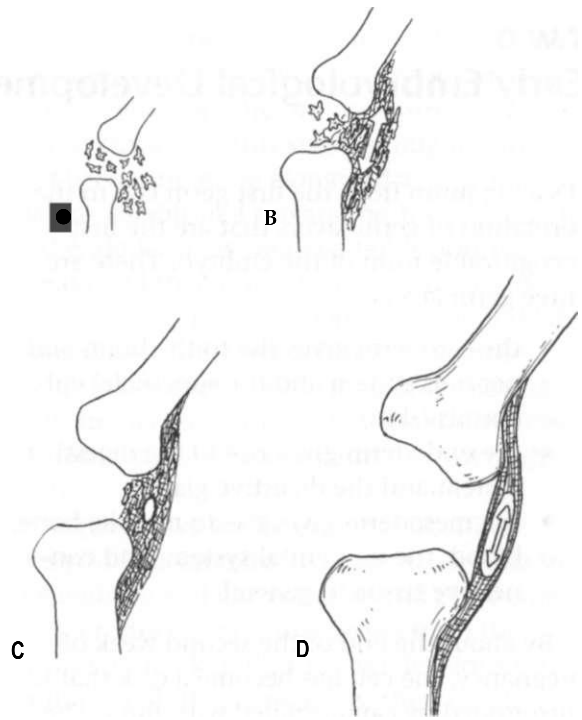


Figure 1-2
This schematic shows an idealized sequence of normal development of tendon from early gestation to just before the baby is born. The process continues throughout life.

(A) Early undifferentiated connective tissue near early newly differentiated bone.

(B) The growth of the bone exerts a directional pull within the connective tissue bed.

(C) Beginning of a more recognizable tendon shape; note that potential muscle tissue is developing within the tendonous bed.

(D) Fully formed tendon with muscle developing along the line of connective tissue tension between the two bones.

T W O

Early Embryological Development

It's a big jump from the first germ cell to the formation of germ layers that are the first recognizable form of the embryo. There are three germ layers:

- the ectoderm gives rise to the brain and nervous system and the superficial epidermis (skin)
- the endoderm gives rise to the digestive system and the digestive glands
- the mesoderm gives rise to muscle, bone, blood, the urogenital system, and connective tissue in general

By about the end of the second week of pregnancy, the cell has become a disk that is surrounded by cavities filled with fluid. The embryo grows by the multiplication of cells, which organize into layers at about the second week. The disk has a top layer (ectoderm) and a bottom layer (endoderm). Direction in the embryo is established at the beginning of about the third week *(Fig. 2-1),* when an area of more rapid cell formation develops in one part of the disk.

At the beginning of the third week, the embryo is about the size of the tip of a pencil point. The area of greater proliferation is approximately a quarter of the total surface area. It rapidly condenses into a line which is called the primitive streak. This is the tail end of the embryo; it eventually becomes the anal region. When the primitive streak is established, the middle layer (mesoderm) begins to develop. The process of growth in the embryo

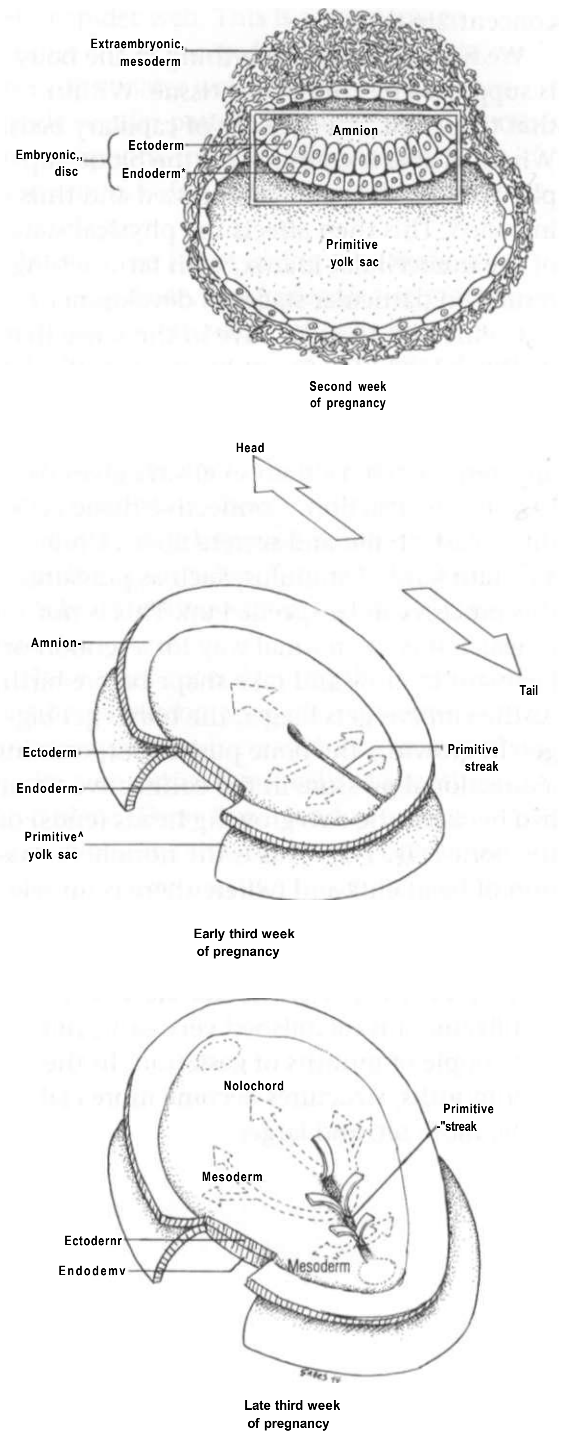
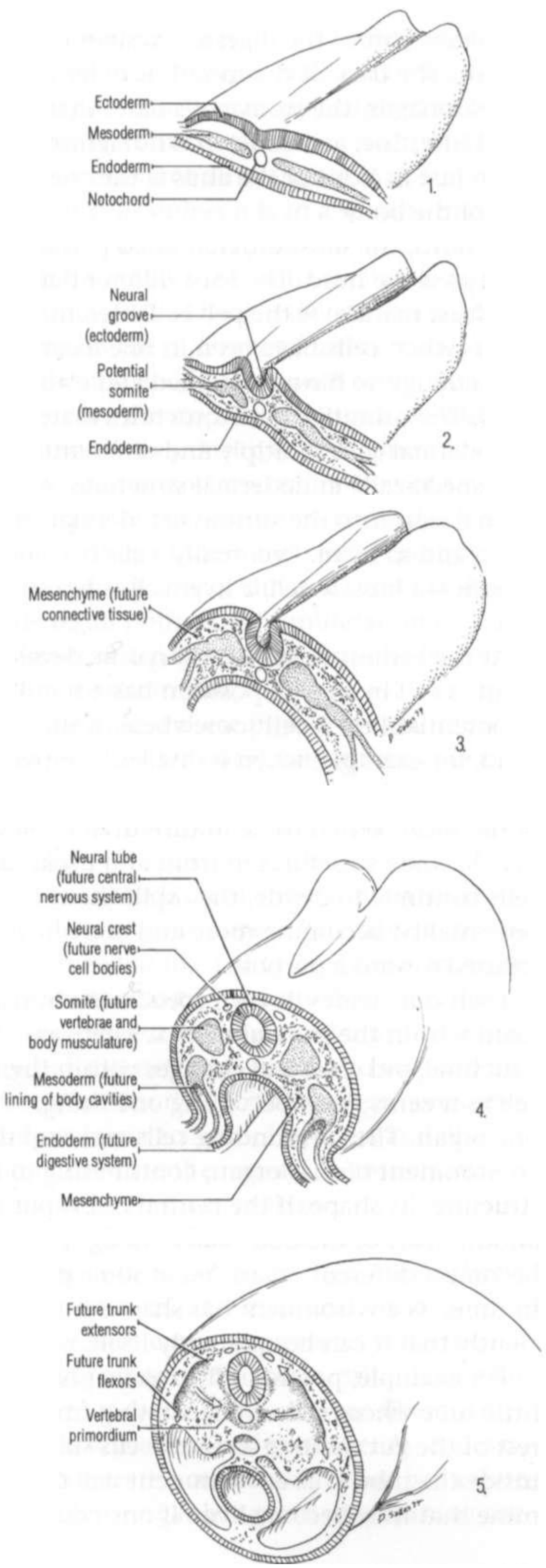


Figure 2-1
A three-dimensional view of the embryo at the beginning of the third week of pregnancy, showing the initial differentiation of ectoderm and endoderm and the first indication of directionality, as well as the notochord, which marks the location of the future spine.



now becomes twofold: cell multiplication by division of existing cells, and the generation of new cells from the primitive streak.

The embryo at this stage is roughly oval and becoming more elongated as it grows. Having established top and bottom (ectoderm and endoderm) as well as a tail (primitive streak) and therefore a head for our embryo, we can now know which are its right and left sides. Cells proliferating from the primitive streak are enlarging and elongating the disk. Cells immediately in front of the source (the primitive streak) develop into the rest of the body.

Logically, we would expect that either everything is established at the same time in the embryo and grows bigger and more complex; or, since everything grows from the primitive streak (tail), this end develops first (initially tail, then the pelvis, then chest, neck, and finally the head). In fact, neither is the case. Nature doesn't share our sense of logic.

The primitive streak remains primitive (undifferentiated). The new cells created from the primitive streak become the head and then the rest of the body from the top down. The head is gradually pushed away from the source as the rest of the body grows between. The top end is pushed farther and farther away from the source.

Multiplication of cells is taking place throughout the embryo, not only at the source, although the greatest generation is there. The embryo is growing geometrically: lengthwise, sideways, and internally. The shape changes from a disk into a round, body-like shape. The circular disk was like a slab of "silly putty" that got pulled length-

Figure 2-2
This cross section sequence illustrates stages of development during the third and early fourth week of gestation, showing the changes from early germ layer pattern to recognizable structures.

wise. As longitudinal pressure increases, the edges begin to curve inward, closing to form a more tubular shape *(Figs. 2-2, 2-3).* The outside (which was the top of the disk) is the ectoderm. The inside (originally the bottom of the disk) is the endoderm. The mesoderm is the filling between these two layers.

The primitive streak is the first "structure" differentiated from the general mass of the primitive embryo. It later becomes the anal region, so that we may say that this region is the "oldest" part of the body. After the anus,

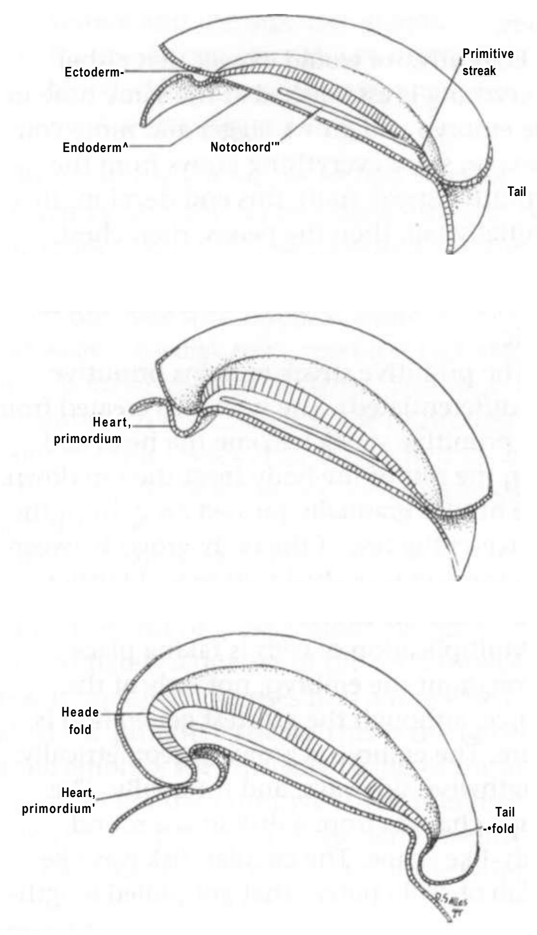


Figure 2-3
This mid-sagittal (lengthwise) sequence shows the folding of the body during the third week of gestation. The same structures are present as in Figure 2-2.

the oldest part of the digestive system is the mouth. The back of the mouth is older than the esophagus, the stomach is older than the small intestine, and so forth. The sigmoid colon just in front of the anus is the "newest" part of the body.

At birth, the most differentiated part of the embryo is the head. The least differentiated (the least mature) is the pelvis. Differentiation occurs when cells have been in one location long enough to have multiplied and elaborated. The primitive local structures mature. Endodermal cells multiply and differentiate into specifically endodermal structures; ectodermal cells into the various ectodermal structures, and so forth. Eventually, cells become specific—a muscle cell, a liver cell, a brain cell.

At the earliest stages of embryonic development, a cell in a given position has a number of potentialities. A cell somewhere in the head, for example, when it divides into two, may be dividing into the left and right sides of the head. When these in turn divide, they may become structures in front and back. As cells continue to divide, they split their potentiality, becoming more and more focused toward a purpose.

Each cell creates its own specific environment within the general matrix. There are structural and chemical changes within the cell as it zeros in on becoming one thing, one organ. The surrounding cells make up the environment of that organ, contributing to its structure, its shape. If the central cell is put in another part of the body early enough, it can become a different organ. Yet at some point in time, its environment has shaped it sufficiently that it can become only itself.

For example, potential liver at first is just a little tube whose cells are separating from the rest of the gut. As long as these cells stay inside the tube, this environment will determine that they become liver. If one could dissect away one of those cells and put it in a nearby environment, it could become a pancreas. As described in many standard embryology texts, it has been shown that potential pancreas does not differentiate into mature pancreas cells unless it is in a specific mesodermal environment (potential fascia). Relationship to the surrounding fascial tissue is important; it may be the specific energy field that makes the difference for this tissue.

About the end of the fourth week, the embryo has developed primitive arms and legs as well as a primitive brain, primitive spinal column, and the beginnings of vertebrae to protect the central nervous system. It is now shaped like a tube and is getting bigger, particularly at the head end. Its shape is the result both of self-proliferation and of the space restrictions as determined by its outside environment.

Around all of these primitive structures primitive cells are proliferating into "filler." This filler is mesodermal tissue—primitive fascia made up of cells, fibers, and intercellular matrix. Its texture is like glass wool or angel hair, the kind of stringy, fluffy stuff that sticks to your fingers. The matrix is sticky and somewhat like Jell-O in texture. In most places in the body, it stays soft until birth. In other places, pressures and tensions, both internal and external, cause it to respond by getting hard and directional—ligaments and tendons begin to form. Hardness and direction of fiber are the normal factors creating structure in connective tissue.

In the places where bone will form, the soft matrix becomes more rigid, establishing a directional pull. This internal tension, together with external pressures from the confining walls of the uterus, stimulates cells locally to increase production of fibers. An example is prevertebral cartilage. As it grows, its push into the connective tissue bed creates a stress line, organizing and maintaining the integrity of the growing vertebral column. The resulting complexity of pulls along and between the developing bones results in the differentiated ligaments that connect the bones *(Fig. 2-4).*

In addition to a grid-like support from bone, tendon, and ligament, the body gets a "packing material" support from connective tissue. Fat is a part of this material. It is another kind of connective tissue. Depending on its density, it acts to cushion, protect, and pad the body or to provide support and spacing where it's more dense. In adipose (fat) tissue, cells enlarge by accumulating droplets of intracellular fat; fibers and matrix are pushed aside by the engorged cells. This tissue is important in the spatial arrangement of structures. Fat is one of the body's ways of immobilizing or wedging an area.

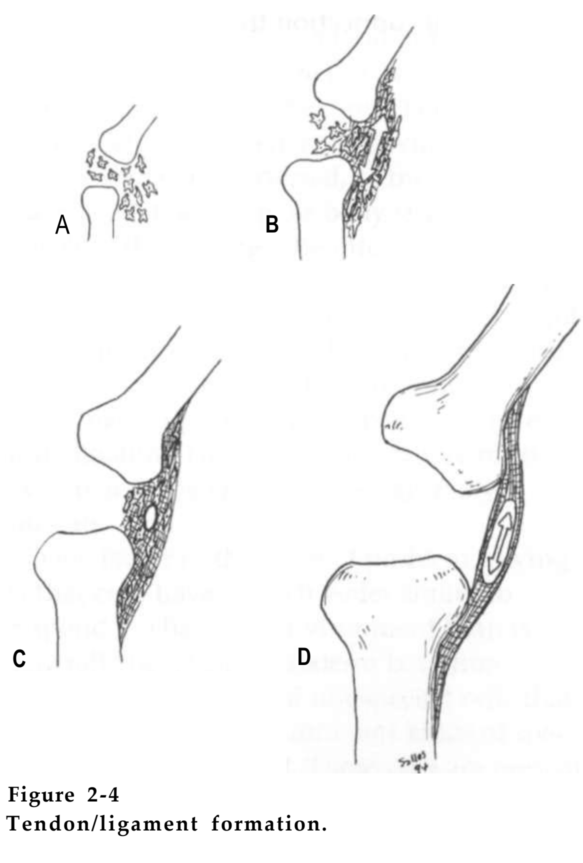


Figure 2-4
Tendon/ligament formation.

As the head fold grows, the endoderm layer (inner lining) grows within the ectoderm (outer lining). Mesenchyme (the primitive mesoderm or middle layer) fills the space between them. As the head fold begins, the back of the mouth begins to take shape out of the endoderm. As folding continues, more and more endoderm is brought into an internal lining, forming esophagus, stomach, and eventually the curvature of the stomach, the coiling of the small intestine, and so forth.

Fully developed endodermal tissue is held in position inside the body by a thin, filmy layer of connective tissue. It is like a spider web that holds structures in place, like thin guy wires. Endoderm structures do influence the conformation (shape and relationship) of bony structure. The large intestine, for example, is almost literally glued to the back part of the abdominal cavity, where it forms a heavy fascial connection that includes a considerable amount of fat. This fat is an important part of the environment of the large intestine, particularly of that part which runs across the abdomen, connecting to the backbone in the area of the lowest attachments of the diaphragm. Thus the inner organs and their "packing material" affect overall body ease and mobility. Emptying the digestive tract, for example, can have a dramatic effect on posture. If the transverse colon is filled with fecal material, it is necessarily restricted in mobility. This compresses the back part of the diaphragm and related spinal junctions. For the most part, however, healthy endodermal tissue can and does adapt freely to other body structures.

Cells start out with the potential to become anything. Gradually they become more specialized, developing into specific parts of the embryo as it grows.

THREE
Factors in the Growth of the Embryo

This overview of early embryological development has been necessarily sketchy and general. However, it provides a framework for discussion of embryological concepts as they predispose and influence the shape and characteristic movement of the individual. Descriptive embryology tells only part of the story. It is a history of general patterns of growth. Minor variations in this developmental pattern allow prediction of the individual's future structure and behavior.

There are shifts in the importance of one factor over another as the embryo grows. At one point, the size limitations of the womb may be the most important. At another time, internal growth and differentiation may take precedence. As described in Section 1, a change in the directional stress in the mesenchyme modifies the organization of surrounding tissue. Every growth stage thus creates new demands and challenges in the internal environment of the embryo. In general, the response is a greater degree of specialization of function.

The external environment becomes increasingly important as the embryo gets larger. Within the womb, there may be some insufficiency of the placenta (there are children who are born with malnutrition). If the mother's diet is inadequate, the embryo will be affected. If the mother takes medication or drugs, this will have a greater or lesser influence depending on the drug, the stage of gestation, and dosage and/or frequency. If she is constipated during much of the pregnancy, this exerts pressure on the uterus.

As the embryo develops, in terms of structural organization, connective tissue is the least specific of the developing tissues. Mesoderm remains relatively amorphous. Ectoderm and endoderm structures are functionally both more discrete and more stable in form. Yet connective tissue becomes increasingly important, establishing the arrangement of structures as the embryo grows in size. There have been few tissue studies of late pregnancy that detail what goes on underneath the skin of the developing infant. It is reasonable to suppose that the great spurts in growth that take place toward the end of pregnancy are the result of an increase in the volume of connective tissue.

The body grows organically, solving problems and meeting needs as they arise, rather than being set up according to a predetermined plan. Genetic predetermination sets the stage; variations are a kind of problem solving. No two of us are the same. No two sides of the body are the same. These variations relate to differences in environment, both internal and external, of the kind we have been describing. As body structures develop, they change the internal environment of the immediate area, creating changes at the anatomical level. There are many slight differences in the rate of development inside the embryo. The orchestration of these variables makes up the physical components of individuality. This is true long before birth, even before the embryo is recognizably human.

One factor in this kind of problem solving is that cells have a much wider ability to respond to changing environment than is generally believed. Mesoderm is a prime example. It has types of nonspecific cells that apparently give rise to different kinds of specialized cells as needed. These cells are present in the embryo, the child, and in the mature adult. We have termed this the "embryonic

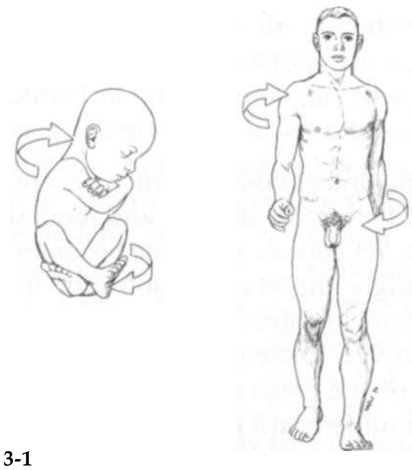


Figure 3-1
The way the baby lies within the uterus determines the ultimate pattern of the spine.

potential of mesoderm." Reticular cells and lymphocytes are examples of this type of cell. Reticular cells in connective tissue very probably act as source cells, giving rise to specialized cells on demand. Lymphocytes in blood and lymphoid tissue accumulate near an area of infection, where it seems that they are able to assume multiple functions as needed in the healing process, even metamorphosing into phagocytic (restructuring cells) or becoming a source of additional connective tissue cells.

Such morphological (shape and structure) responses to environment are the extreme. Yet all cells change their rate of growth in response to environmental stimulus. Even in the adult, if a kidney is removed, within a short time the remaining kidney doubles in size to compensate. Cells for this regeneration come from within the body As the kidney grows, it continues to function as a kidney. Its cellular processes are fully loaded—even overloaded—yet it can make this compensation.

The coordination of timing is a major factor in embryonic development, meshing internal and external environmental demands. For example, as a few cells bud off the endoderm tube to begin to form the liver, this changes the environment of the area as a whole. If this happens at one time schedule, it creates one kind of structure. If it happens later, it creates a slightly different structure. Even a matter of hours is significant. This is the reason that drug effects can be so devastating at one embryonic stage and less so at another. Thalidomide is a recent illustration. If it was taken early, when arms and legs were just beginning to develop, there would be no arms or legs at all. If taken later, only fingers or forearms might be affected.

The embryo develops in all its parts both on a general timetable (the genetic contribution) and on its own individual timetable. This can be a little lagging or a little ahead of the average pattern. Development takes place in spurts. By the end of the second or third month of pregnancy, all the elements are in place. From then on, growth is a matter of becoming bigger, more coiled, or more complex. After the third month of pregnancy, the embryo has dealt with the problem of becoming what it is—an identifiable creature of human type. From then on, it is dealing with a different problem, namely the development into a bigger, more differentiated system. Increasingly, external environment becomes a major factor.

Also at this point, individual variations become increasingly apparent. The embryo shows individual body shape and conformation. The way the baby lies in the uterus determines the ultimate pattern of the spine ***(Fig. 3-1).*** Whether the head is to the right or to the left or between the two legs, how the arms are curled around—all these are important factors in the final shape. As it grows, the embryo (and the infant and adult) expands in size but retains the early pattern of rotation.

Internal environment is primary at the cellular level, more influential when the embryo is very young. As the fetus becomes a child and then an adult, external environment takes on an increasingly significant role.

FOUR

Development of Mesodermal Tissues

We need to digress for a moment to discuss the development of those mesodermal tissues that will become the bones, ligaments, tendons, muscle, and myofascial elements of connective tissue. These are the structural components of mesoderm; they share a characteristic pattern of growth.

It is usually assumed that connective tissue (fascia) condenses around a muscle because existing muscle tissue needs a wrapper. It is our belief that the direction of the connective tissue (tendon or ligament) is established first. Potential muscle tissue caught within this directional pull differentiates into mature muscle oriented along the line of pull. Muscle itself is spongy, able to expand and contract and so exert pressure and friction on its surrounding fascial bed. Muscle tissue is similar in consistency to taffy. Connective tissue gives it shape, direction, and organization, much as the candy wrapper shapes the taffy. Because it is continuous throughout the body, connective tissue generalizes local muscle action. For example, as the biceps move, the whole arm moves, including the shoulder and neck.

This interaction develops early, in the first or second month of pregnancy. Muscle tissue is caught in the middle of the connective tissue directionally while it is still primitive. The clump of primitive muscle cells elongates through directional pressure. At this stage the group of primitive muscle cells changes into differentiated muscle cells. Further growth increases muscle size by cell reproduction. This development may be stimulated by the physical tension present in the connective tissue, or it may be stimulated by the associated energy field *(Fig. 4-1).*

In terms of histology (the microscopic study of tissues), the fascial wrapping of mature muscle is not a true wrapping. It is better described as an area of greater concentration of connective tissue. There is no beginning or end to these structures. Ligaments and tendons do not really attach to bone—they are continuous with the periosteum (a fibrous covering of the bone), which in turn is continuous with the next tendon or ligament. *(Fig. 4-2).*

Anatomists tend to describe the body in terms of its dissectible parts. A living body is a continuous whole. This is especially true of its connective tissue components. The error arises when we think of fascia as a tubular

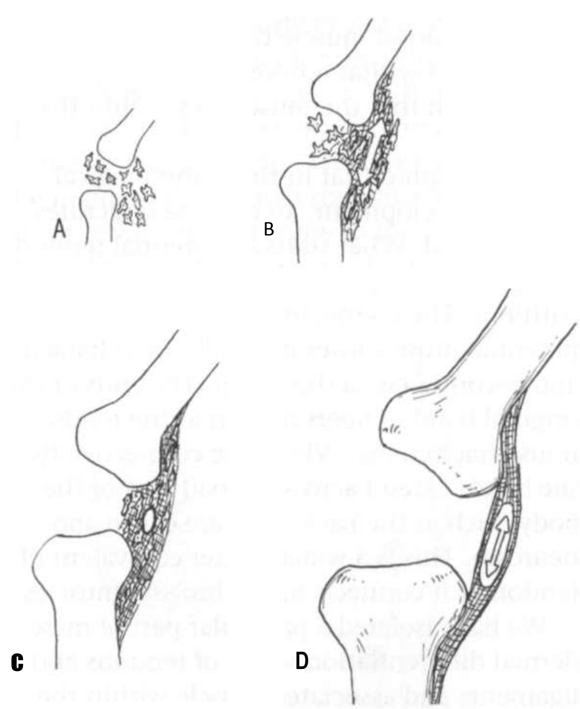


Figure 4-1
This schematic shows an idealized sequence of normal development of tendon/ligament from early gestation to just before the baby is born. The process continues throughout life.

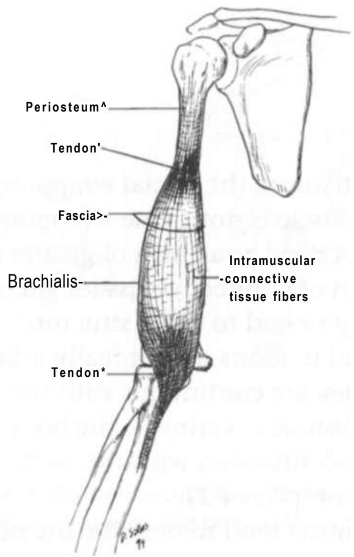


Figure 4-2
Upper arm (brachialis muscle), showing the connective tissue continuity. Periosteum -> tendon -> myofascia -> tendon -> periosteum.

covering around muscle tissue. It is more accurate to say that tendon goes through muscle than that the muscle lies within the tendon.

Keep in mind that in the embryological stage of development, all of these structures are potential. What starts as potential tendon or ligament has potential muscle developing within it. The connective tissue around the potential muscle loses its tendonous character and becomes fascia (bedding). The ends of the original band of fibers remain as the tendonous attachments. Where the connective tissue bands extend across a broad area of the body, such as the back, they are called aponeuroses. This is a wider, flatter equivalent of tendon as it connects to the broader muscles.

We have isolated a particular part of mesodermal differentiation—that of tendons and ligaments and associated muscle within the connective tissue bed as a whole. What do we mean by differentiation? What really happens when connective tissue structures get organized? As cartilage (which will be replaced by bone) pushes out into the connective tissue bed, directional stress lines are established. These have one character along the bone and another between the bones. The connective tissue component within these stress lines is stimulated to increase fiber production, and these fibers are arranged along stress lines. This reinforces the directional pull within the connective tissue bed, stimulating more fiber production.

Traditional anatomy describes the average soft tissue structures of the body. We have found a variety of atypical connective tissue bands and compressions that are illustrated in no anatomy text. We have interpreted these as an individual response to idiosyncratic patterns. These patterns can include habitual gestures or posture, compensation to injuries, individual rates of growth, and environmental stresses of all kinds. This kind of individual response is apparent as early as the third month of intrauterine life.

Around the sixth month of pregnancy, size limitations in the uterus become a factor. The more stringent this limitation, the greater the likelihood of adaptation. In many infants, for example, the connective tissue on the outside

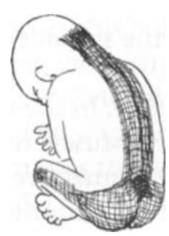


Figure 4-3
The folding of the full-term baby in the uterus creates normal fascial tensions, resulting in localized thickenings of connective tissue.

of the leg becomes thickened. The legs are held folded within the uterus so that tension is created between the knee cap and the hip. Where there is this kind of pressure, the stimulation causes a heavier concentration of fibers, forming a thickened sheet of fascia. This is not a response to internal need, but a response to outside pressure ***(Fig. 4-3).***

FIVE
Embryonic Limitations and Early Structural Organization

As the fetus grows, environmental pressures begin to dominate. At six months, the fetus is really being pressed by the limitations of space. This is particularly true if the mother's posture or structure supports the pregnancy with difficulty. The child moves around quite a bit, so that it does have some ongoing choice. Especially toward the eighth month of pregnancy, however, this movement tends to be restricted to the limbs because there is so little space.

The child's position in the uterus is thus important in its structural development and alignment. Whether the head is to the right or to the left of the knees, where the arms are in relationship to the spine—these factors establish the individual pattern of the vertebral column. We assume that the position of the head on the neck is determined by these spinal rotations ***(Fig. 5-1).*** It was Ida Rolf's assumption that this relationship is established as early as the first week of pregnancy. Such primary rotations are augmented and compensated by intrauterine limitations during late pregnancy.

Other places in the body may show idiosyncratic changes in structure, changes away from simple efficiency. What, then, is simple efficiency? It may be visualized in terms of the concept of an embryonic, undifferentiated connective tissue bed in which there are directional pulls. As the bones grow into this bed, their protuberances act as hooks, providing focal points of soft tissue tension ***(Fig. 5-2).*** For instance, the anterior superior spine of the ilium (the top front corner of the hip bone) "snags" the broad fascial sheet that comes up the leg from the knee. This creates converging folds at that point. The sheet of fascia also thickens on the side of the thigh, where it is called the ilio-tibial tract. The anterior superior spine acts like a hook suspending a piece of fabric. The muscles of the thigh lie within the folds.

Another pull is down to the pubic bone from the rib region. The muscle most directly influenced is the rectus abdominis, the "sit-up" muscle on the front of the abdomen. Its ease and length seem to relate to the degree of curl as the child lies in the uterus.

Nowhere are these pulls in isolation. There are always cross-tensions among them. We have described a line of force down to the pubic bone and one up to the anterior superior spine. In addition, there is a torsion between these two bony protuberances.

The soft tissue organizes as a sheet across this area, which is the groin. Within the sheet there are specific areas of concentration of connective tissue fibers. The most apparent is the inguinal ligament, a rope-like band from the anterior superior spine to the pubic bone. When this is too heavy and short, it restricts

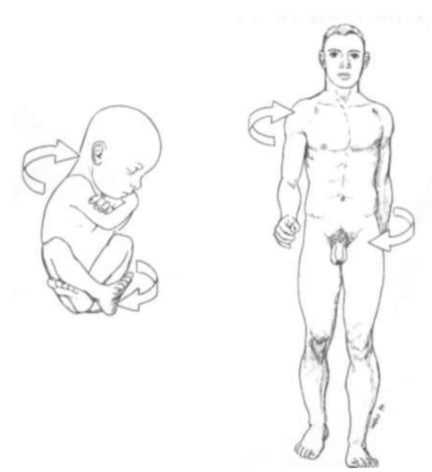


Figure 5-1
The rotations in the fetus continue into the structure of the adult.

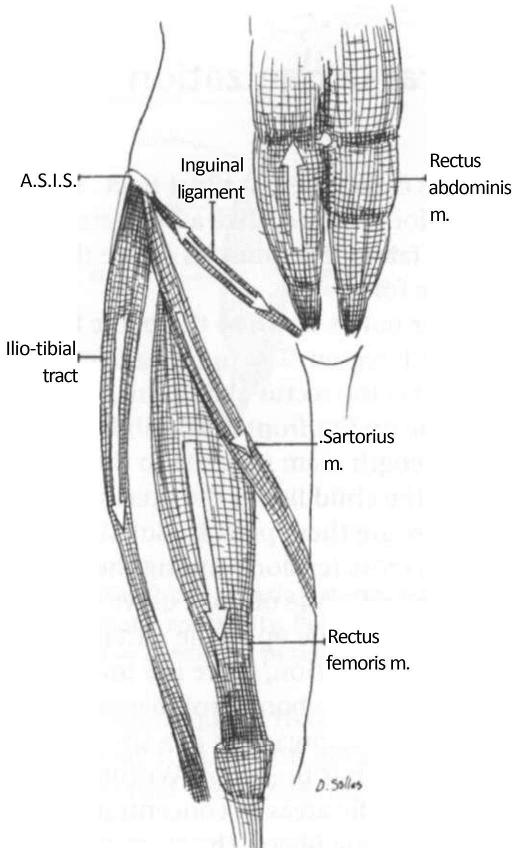


Figure 5-2
Arrows pointing in one direction indicate the major tensions that are unidirectional. Note the tensions on the inguinal ligament are bidirectional between the ASIS (anterior superior iliac spine) and the pubic bone (not labeled).

movement; when it is insufficiently established, the groin sags.

The lumbo-dorsal fascia, which lies in a heavy vertical band on the back, is a soft tissue structure that is established by the hooking effect at the spinal flexures, those places where the degree of bending in the spine is greater. The fetal spine does not describe a smooth continuous "C" curve; it is a segmented curve. These segmental junctions are established before the bones start to form. These junctions probably determine regional variations in the shape of the vertebrae. The fetal curve itself is not a response to restriction from the womb; there seems to be genetic determination for that curve that is later reinforced and redirected by the muscular pressure of the uterine walls as the child grows.

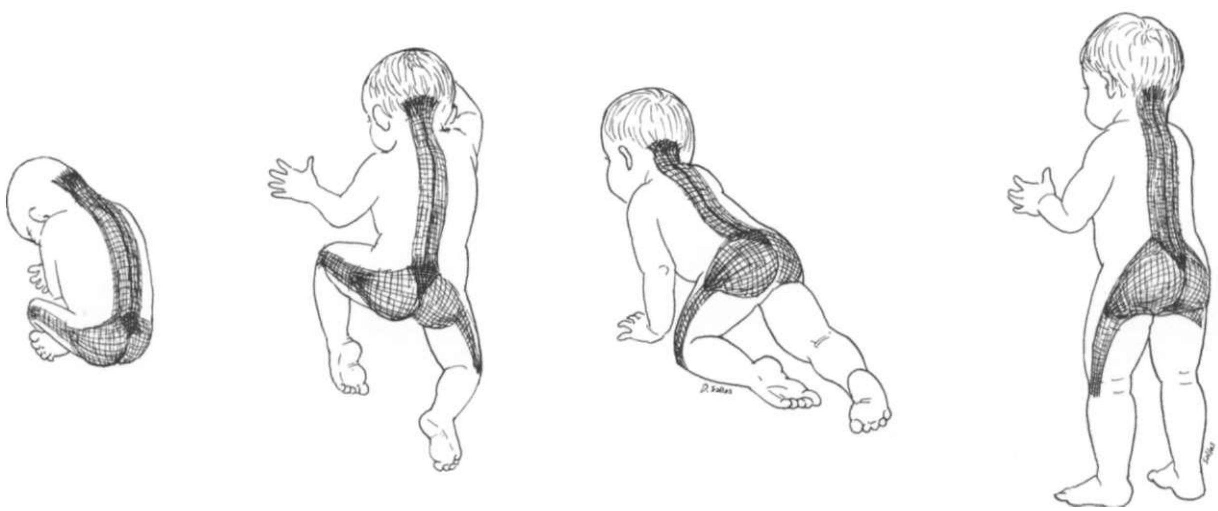
By the time the fetus is full term and ready to be born, it is a balanced network of soft tissue pulls reflecting the interaction between its genetic blueprint and intrauterine stresses. When the child is born, it has to start working—literally—to counteract some of the habits that are already established in its body. Its spinal curve and a kind of crouched position of legs and arms must be opened and lengthened *(Fig. 5-3).*

At birth, the head nods forward and the hip turns under. A human being in the womb is born in a natural stoop. He straightens for many reasons: for comfort, to mimic, for efficiency of movement, to explore. As these new physical habits are established, they induce additional cross-stresses within the connective tissue network. Previously established stresses dissipate from lack of use, they may be modified, or they may remain as a substructure within the body.

The knee-up position in the fetus makes an almost direct line of restriction across the pelvis between the lower back and the inside of the thigh. This stress line is continuous with the fascial thickening on the small of the back. The combination is a compressed, leaning "S" curve between the lower back and the leg. This structure is functional in the womb and as the child crawls. But as the body begins to stand, the shortness is felt as a restriction that inhibits secure upright balance. Gradually, as demand for stable movement increases, this tissue must lengthen. Or, as is more usual, the growing child finds compensations around the shortness to serve its needs. The lumbar spine (lower back) may come too far forward, or the legs may be pulled up and into the body.

There are numerous examples of such restrictions in fascial sheets and connections as the child develops in the womb. This may be the origin of so-called spontaneous curvatures. Children who have shown no prior structural problems can suddenly develop a curvature (scoliosis) just before puberty. This is not a rare occurrence. It is possible that the pattern of the curve may have been established in the soft tissue relationships of the spine early on. The demands from growing body weight and increasing control of movement then bring out the inherent weakness.

Figure 5-3
The myofascial structures elongate and change relationship as the baby moves from fetal curve (A), to creeping (B), to crawling (C), and on to the first steps (D).



A B C D

PART TWO

Connective Tissue Body

SIX

The Effect of the Birth Process

The term "birth trauma" has considerable emotional impact. From a physiological point of view, the actual passage need not be structurally damaging. There might be some difficulty because of the size of the head and shoulders, yet this should be transitory. A prolonged period of labor may be a source of tension, but even twenty-four or forty-eight hours should not under ordinary conditions make that much difference to structure.

Birth is an extraordinary condition. The infant is experiencing a total change in environment. It has no established ways of dealing with all this newness. At birth, the baby is a wide-open system. New stimuli, because they are new, are magnified in their import both physically and emotionally. It is a truism in psychology that what we learn under panic conditions is with us for life. Traumatic sensory attack, such as being held upside down under bright lights, can induce structural contractions or sensory shutdown that may never go away. This is a cultural rather than a physiological part of the birth process.

Birth is the beginning of new environmental influences on structure, ones arising out of cognitive impact. There are basically two different kinds of malfunction in the body—those caused by traumatic (external) stress and those that result from developmental (internal) stress. We tend to accept the latter because "that's just the way the world is" or "that's just the way my body is." We have no comparisons. We can never know how we would feel without that stress.

Breathing is one of the major new things that happens with birth. It would be interesting to compare a LeBoyer film of the first minutes of infant delivery with a film of more traditional births. The French obstetrician instituted deliveries of the baby under water. First efforts to clean off the baby were done in the water and no suctioning of airway was deemed necessary. More traditional birthing now includes vigorous toweling and drying the baby as well as suctioning to clear the airway. Birthing techniques of the first half of this century included holding the baby inverted by the feet until the first cry was heard to be sure the airway was clear.

What happens to the diaphragm and the ribs with breathing in the different kinds of birthing? Intrauterine breathing movements have to be shallow because the abdomen and upper ribs are sharply compressed in the fetal position. Only the lower ribs (and possibly the diaphragm) can be involved. The first breath after birth starts the process of pushing the fluid out of the lungs. Breathing has actually started before birth, and some amniotic fluid needs to be expelled. That was the rationale for the shock. The spanking and holding the newborn upside down were used to ensure that the lungs were cleared.

As adults, we tend to be either chest breathers or abdominal breathers. Does the first breath of the neonate initiate the pattern? In abdominal breathing, the diaphragm moves up and down and the increased volume of air is accommodated in the abdomen. In chest breathing, the diaphragm also moves up and down, but not as much. Abdominal breathing quiets the body and draws the focus of energy lower in the body, a pattern well suited to meditation. Chest breathing draws the focus of energy upward into a more active pattern. (In our view, the desirable resting state is a balance between the two—see *Fig. 6-1.)*

As the support of uterine constriction is

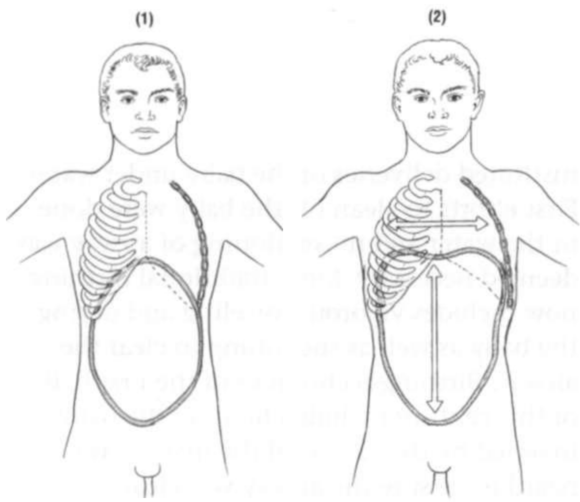


Figure 6-1
In a balanced combination of chest and abdominal breathing, the abdomen lengthens (vertical arrow) and the rib cage widens (horizontal arrow). The inhale is shown in Figure (2); we have exaggerated the drawing for greater visual impact—this is what it feels like but the visible effect is less than this illustration suggests.

lost at birth, there are new pressures from blankets, sheets, diapers. Diapers are the most insistent pressure, but even sheets and blankets probably create more pressure than we suspect. It was once common to pin down infant sheets. Lately, instead of putting the child under a blanket, he or she is put into one or more sleepers and has a little more freedom of movement.

The child was exposed to light and sound in the womb, but these were muffled. At birth, sensory input is increased in intensity. Probably it becomes a traumatic factor only if it is sudden and/or highly intrusive. A fetus is subjected to more sound than we suspect. When the uterine wall is fully extended, it is very thin. Both light and sound can and do come through. There may even be an intrauterine need for the infant to withdraw by contracting.

Touch is the earliest sense response, established at about one month of gestation. Tactile stimulation changes radically at birth. In the uterus, there is fluid covering the child in addition to the uterine musculature. At birth, this amniotic fluid is no longer there. At birth there are sudden intrusions of foreign textures such as sheets, rubber-gloved fingers, suctioning devices, and rectal thermometers. The whole skin is an organ of touch. The laying on of gentle hands at birth is something we all know to be important. It is good to see it so beautifully represented in LeBoyer's* film of birthing. With the work of the second generation of progressive ideas in birthing/ gentle ways of stimulating sensory awakening have been found—for example, blowing air on the chest or using the mother's voice in a low monotone to stimulate breathing.

The change in the quality of sensory response to the new environment is the first challenge the baby faces. How this change is handled has a marked effect on identity. Structurally, a defense response is expressed as tissue contraction and withdrawal. A shock to the system, taking the infant directly into defense, may start a way of being. Often, it seems as though a baby's first cries are really angry or fearful. The connective tissue response to that first emotion can last through life.

*See Frederick LeBoyer, *Birth Without Violence* (New York: Knopf, 1975).
fSee Michel Odent, *Birth Reborn* (New York: Pantheon, 1984).

SEVEN

Developmental Transitions in the Newborn and Young Child

Development is not complete at birth. Birth marks a transition toward a greater and ultimately more refined use of movement. The connective tissue is the system by which we mediate movement, yet structurally, the least complete system is the connective tissue. Increased demand for movement furthers maturation of the connective tissue. As we use a part, it becomes more capable, more skilled. In turn, as we become more skilled, we explore a wider range of movement. Feedback systems can operate to increase the range of movement, or the circuit can get shunted and go into a downward spiral. Feedback systems are characteristic of all living organisms.

There is very little information available about muscle, connective tissue, and organ development late in the fetal cycle. After the first three months of pregnancy, more embryology texts concentrate on the growth of external form. The sequence in which the head develops ahead of the tail and the back ahead of the belly is maintained, as far as we can tell, after birth.

Figure 7-1
At birth, centers of ossification are more fully developed in the upper body than in the lower. This is especially noticeable in the space between the bony ossifications in the pelvis and legs when compared to the shoulders and ribs.

In the newborn, the bones of the head and chest are relatively well developed. The pelvis is largely cartilage, with small disks of bone ***(Fig. 7-1).*** Because the hip cartilage is malleable, how a child habitually lies in the crib has great effect on this lower structure. If he or she lies on the back or front, the legs tend to be splayed out because of limited pelvic ossification as well as lack of soft tissue tone to pull the legs together.

At birth, the most developed pelvic musculature is in the back. The gluteus maximus muscle is very well developed. The erector spinae (long muscles of the back) are strong, while the belly wall is less so. Those muscles that tend to pull the leg toward the middle (adductors) are even less strong. Swaddling, the practice of binding a newborn closely in cloth, wraps the legs so that they are held close together. It may be that isometric movements of the infant within this wrapping stimulate balance in the hip joint.

Developmental rates and patterns set up the stresses; learning to use the body reinforces the process. The majority of children, when they start to stand up in their cribs, pull themselves up with their arms and shoulders. They are using their stronger parts to hoist themselves up on the cartilaginous, rubbery legs and pelvis. Observe a small child who has just discovered how to stand. The child spends the day going up and down, pulling up with his arms, getting rubbery on his legs, falling down, coming up, getting rubbery, and so forth. He is visibly exploring the balance possibilities in his pelvis. If the hip joint has reached the stage where the tissues are mature enough to sustain this exercise, all is well. But children (and parents) are often too eager. Overuse or use of a joint before it is adequately developed can physically change the shape of the joint itself ***(Fig. 7-2).*** Or the

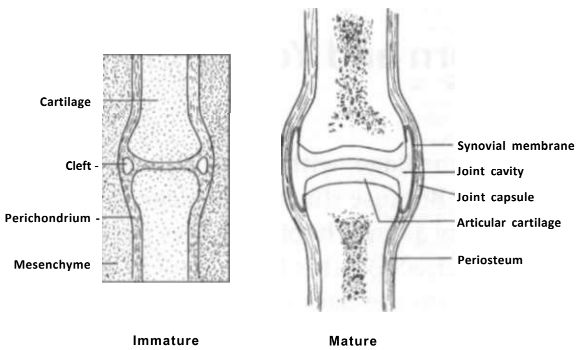


Figure 7-2
The essential difference in the comparison of mature and immature joints is that the immature "bone" is still cartilage. Thus the immature joint is more pliable and, unfortunately, is more deformable by misuse.

misuse may be less drastic—simply a habitual way of moving.

We define a myofascial structure as immature when it is insufficiently developed to meet the demand for movement. Any joint can be immature either structurally or in its pattern of use. The heel is an excellent example of this. Without a well-developed heel, the foot would be more like a long extension of the leg. A mature heel acts as a fulcrum through which the foot and leg relate to each other. Babies don't have this kind of heel until they begin to walk *(Fig. 7-3).* The bone and tissue elements are present, but the soft tissue hasn't been shaped by use. When the child starts to walk, it usually stands on the balls of the feet. It has to because the heel can't reach the floor; the muscles connecting up the leg are not yet extended and the two heel bones are still wedged up into the ankle joint between the tibia and fibula. Eventually, the bones are worked free and the mature heel rests firmly on the ground.

Adequate flexibility at the joints is the anatomical definition of maturity. Where there is immaturity in a joint, it is chiefly a quality of the soft tissue portion of the joint. When it is inelastic, contracted, or pulled off course, movement cannot "flow through" to the bones. Range of movement is restricted. Maturity in a joint is the exploration of the full range of possibilities while still retaining stable movement.

Joints become mature with use. This process accelerates after birth with kicking, rocking, looking around, and so forth. It is important to remember that a child doesn't start with walking. If the child doesn't crawl before it walks, it is likely to have motor uncoordination for life. The child may also have a brain incoordination, manifesting as disabilities in thinking, reading, seeing, and learning.

In crawling, an infant works with the connection of the fascial sheets between the

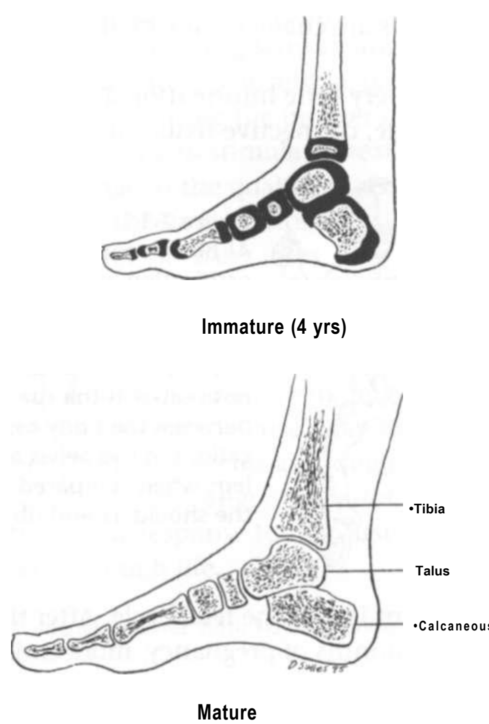


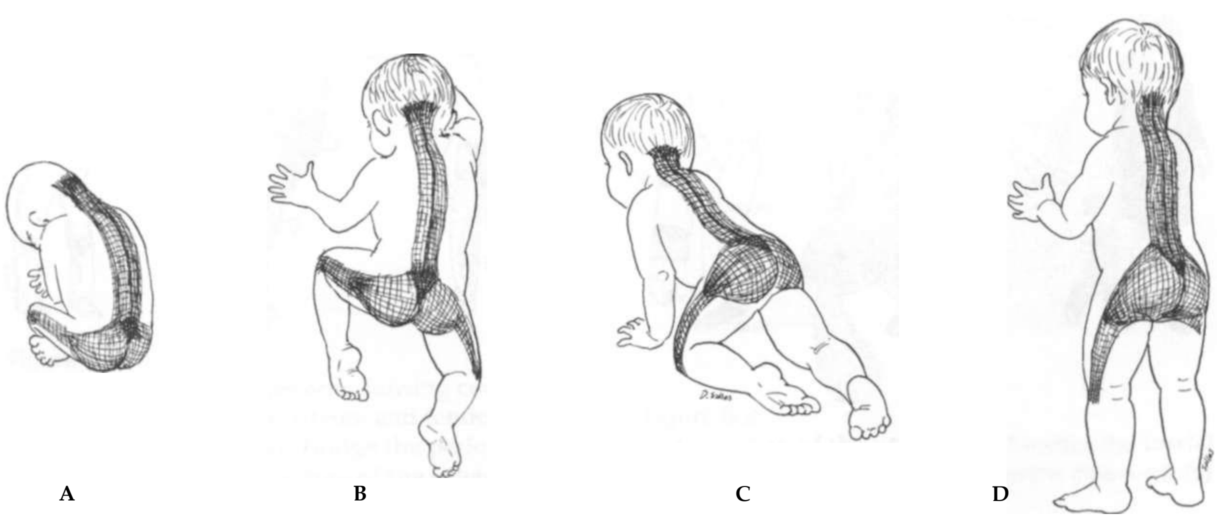
Figure 7-3
The black outlines in the immature foot represent cartilage that will eventually be replaced by bone. Note the difference in the shape of the talus as it is molded by ossification and use. Concurrently note the change in the position of the calcaneus.

outside of the knee and the hip and on up into the back *(Fig. 7-4).* Crawling redirects the flexures of the fetal position. It is necessary for the child actively to use this position before going on to the elongations of the body required in walking. Crawling seems to establish the lower back (lumbar) curve. It reinforces a simultaneous pattern of right angles at both the hip and the knee. Crawling develops the use of the pelvis, bringing it toward the level of maturity of the shoulders and belly. A crawling child practices synchronizing the arms and legs, as well as right and left sides.

At birth, the pelvis and legs are primarily cartilage. Proportionately, the arms have more bone, there is a fair amount of bone in the ribs, and the upper vertebrae have more bone than the ones down toward the lumbar region and the sacrum. The full replacement of cartilage by bone in the skeleton is not complete until the age of twenty to twenty-five. When there is still cartilage in the vertebral column, it may be easier to change its conformation because of its greater malleability. At the same time, it may be that any stability in position is harder to keep.

An elderly person with a severe scoliosis is at the other end of the spectrum of malleability of cartilaginous tissue. There are mineral deposits in the disks between the vertebrae, which then become more or less rigid. Disks consist of fibrocartilage, which is dense and fibrous. Functionally it is similar to bone; histologically it is an intermediate stage between cartilage and bone tissue. Fibrocartilage itself comprises a spectrum of density—it can be rigid like bone or rubbery like cartilage. The difference between one kind of connective tissue and another is in the amount and organization of the fibers and in the density of the intercellular matrix. Within limits, any of these tissues may move in the direction of increased rigidity or at another time, reverse to the direction of greater fluidity. This can happen at any age.

Reversibility of tissue density is an instance of the embryological nature of connective tissue in the adult. Impacted areas, such as between the shoulder blades or across the top of the pelvis, can feel like tendons. Like tendons or ligaments, they are the functional response to need. We all have ways of shoring ourselves up against the stresses of weight and constriction. We create short "ropes" and



A B C D

Figure 7-4
(A) before birth; (B) creeping; (C) crawling; (D) standing.

folds across a joint or wide cross bands to stabilize an unbalanced shoulder or hip.

The problems begin when we attempt to work against rather than with gravity as we move. When a child first starts to walk, she gets up and aims toward a table or some other support. She sort of falls forward, and her legs move under her to keep her upright. If she leans back at all, she sits. She soon learns to prefer falling on her bottom to falling forward on her face. The result is that she starts to balance on the back of her legs. If this pattern persists in the adult, there will be trouble.

When a child is held with his arms up, he brings his legs forward to walk ***(Fig 7-5).*** As his legs move out in front, he feels that he is falling backward and starts compensating: the lower back comes forward, the shoulders go back, and the head comes forward to balance. A further complication is that bulky diapers force the legs apart. It is interesting to see how many adults walk with this kind of configuration—head forward and legs splayed.

After birth, the activities of breathing, turning over, sitting up, grabbing things, looking for things, crawling, and walking are the primary stimuli to convert the immature structure of the newborn into a competent, independent child.

There are also less obvious demands—subtle expectations that start very young. We expect different things from a baby girl than from a baby boy, for example. Some of this may even start before birth; in so many cases, the child is talked about as "he." Infants and children are natural performers and they get a great deal of reinforcement to act, to mimic. ("Isn't that cute; just like his father.") Another way of saying the same thing is that children are natural seekers of attention and approval. A woman who had a lot of injuries to one leg said, "My mother used to tell me that when I was about three years old I followed my father around in the garden and imitated his limp." Perhaps not surprisingly, this was the same leg she repeatedly injured.

As a baby learns to use its body, it has many options. As it grows older, this wide-open range of possibilities narrows in favor of greater precision of movement. Premature use, inappropriate imitation, or a too-early demand for precision can skew the joint out of true, creating restriction, lack of precision, and eventually, pain.

Figure 7-5

EIGHT

Myofascial Structures

The Spine as an Example of "Living Anatomy"

The "organ" that transmits movement in the body, that makes a structural whole of us, is the mesodermal tissue—the connective tissue. These hard and soft tissues together make up what Ida Rolf called the "organ of structure." Connective tissue varies in terms of the physical nature of its intercellular matrix and in the number and density of its fibers. In descriptive terms, this means that some is harder or softer, some is more elastic or more rigid. Connective tissue is continuous throughout the body from toe to head. Bone, for example, is a concentration of hard intercellular matrix within a connective tissue bed. Histologically, therefore, bone is continuous with the total bed of connective tissue.

Myofascia, too, is a specialized type of connective tissue. It is a heavier condensation of fibers at the surface of muscle. Myofascia also exists as layers between muscles, relating the more superficial surface muscles to those deeper in the body as well as connecting adjacent muscles into groups. We consider fascia to be a continuous system, extending throughout the body between the deepest bone level (periosteum-tendon-ligament) ***(Fig. 8-1)*** and the layer just under the skin (the superficial fascia). It is a layering of sheets of fibrous tissue that flows through the body, eddying around bony protuberances that compress and redirect its flow. It is the packing material of the body; it makes up our contours and holds us in place.

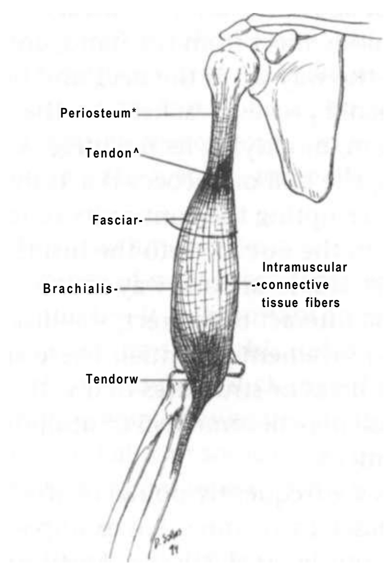


Figure 8-1
Brachialis muscle in upper arm showing continuity of connective tissue: periosteum and tendon with fascia. Ligaments similarly bridge the periosteum of one bone to the periosteum of the other bone in a joint.

Muscle lies within fascial sheaths. In addition, fascial fibers interpenetrate the muscle, wrapping around smaller muscle fiber groups ***(Fig. 8-2).*** Muscle fibers expand and contract, exerting internal pressure on this myofascial tissue. Acting like a guy rope, the fibrous

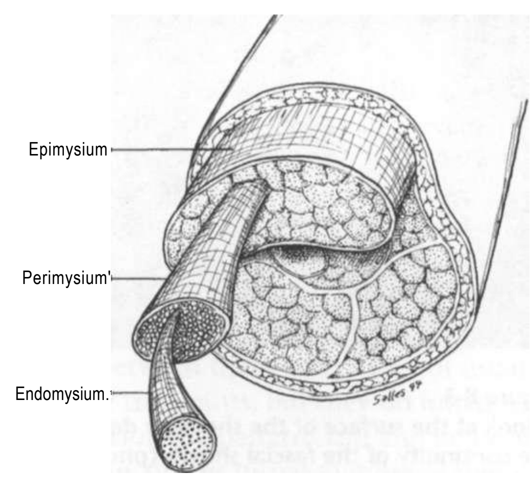
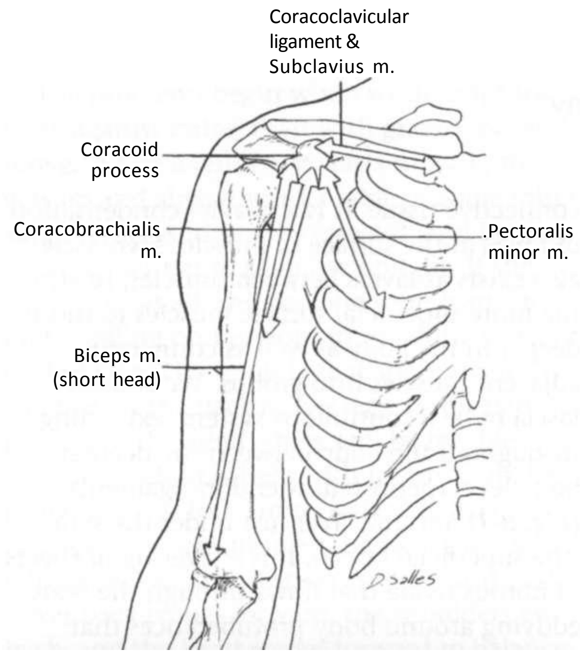


Figure 8-2
Cross section of the upper arm showing the fascial sheaths (labeled) surrounding muscle fibers (dots) and muscle groupings.



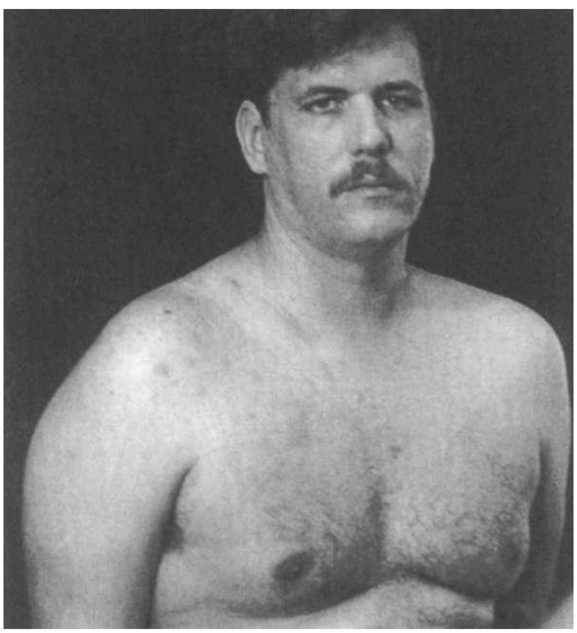


Figure 8-3
A look at the surface of the shoulder demonstrates the continuity of the fascial sheath (photo). The underlying fascial pulls graphically illustrate the complex dynamics focused on the coracoid process (drawing).

fascial sheath then transmits the movement to the periosteum of the bone with which it is continuous. In adults as well as in the embryo and neonate, where the myofascial covering has become toughened (as it does through habitual tension or holding), it condenses to encase the muscle in such a way that there is less capacity to lengthen and to move.

As we have said, the myofascial bed of the adult, as well as of the embryo, responds to habitual tension with a localized increase of fibroblasts and increased secretion of fiber in the direction of pull. This creates a tough envelope that encases the muscle, reducing its capacity to lengthen or move freely. The focus of Rolfing is this toughened myofascia, and it can be felt to regain its natural elasticity as Rolfing proceeds. We therefore have reason to believe that this toughening of the myofascial sheath is reversible.

Fascial sheaths get "snagged" on bony hooks. An example is the coracoid process, a bony projection on the inside of the shoulder blade just above the armpit. Fascia extends as a continuous sheet from the hand, arm, and chest all the way up to the neck and head. The coracoid process reaches into that fascial continuum, modifying its flow ***(Fig. 8-3).*** Similarly, the tailbone (coccyx) acts like a hook, interrupting the continuity of fascial tissue from the outside into the inside of the pelvis. Hooks are one way that bone and myofascia interact to redirect, stabilize, or magnify movement potential. These are therefore areas or structures that with improper use may become foci of inhibition of movement.

Hooks are frequently points of attachment for myofascial structures. For example, the coracoid process is the point of attachment of muscles from the arms to the shoulder. On the other hand, the tailbone is only minimally a point of attachment for the muscles from the leg to the trunk. Yet the tailbone's effect on leg movement becomes apparent if it has been displaced in any way—moved to the right or the left, too deep or too close to the surface—then there is interference with the easy swing of the leg. Injuries to the coccyx are common in childhood, and easily ignored. They are difficult to treat—it is impossible to put a cast on a tailbone.

Bone projects into the connective tissue bed with broad surfaces as well as with hooks. The upper rim of the hip bones, the edge of the lower ribs, and the shin bones are examples. These, too, serve as areas of attachment for myofascial units. In general, these broader surfaces are connected with more superficial soft tissue organization. Smaller points of attachment usually serve to redirect deeper-lying tissue.

There is a functional reasonableness to the combination of myofascial sheets and bony points of reference. The growing bone sets up stresses (directional pulls) in the connective tissue in utero. When these are from a single point (for example, the way the hamstrings attach to the ischial tuberosities), the result tends to be a grouping of rope-like structures. When the pulls are from a broad area (for example, the transverse muscles covering the abdomen), the result is more like a broad sheet.

"Point of attachment" designates the supposed endpoint of movement for a muscle or group of muscles. It is important to remember that fascia continues past this point of reference. Points of attachment change the quality of movement. They change the strength of the gesture and absorb some of the energy of a movement before transmitting it to the rest of the body.

Ideally, movement from a gesture travels through the arm or leg or head toward the spine. Movement transmits as a wave down the spine as well as across the spine and into the other side of the body. Thus, when the arm moves, that movement should continue wavelike through the neck and into the head. Yet there is frequently a blocking of the movement. For example, at the junction of the neck with the chest vertebrae, there is often a chronic holding pattern that in later life in women is called a dowager's hump *(Fig. 8-4).*

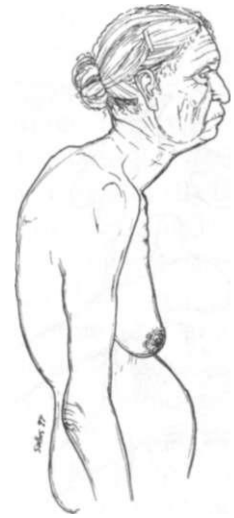


Figure 8-4
Dowager's hump.

Since the spine is the focus of so many movement difficulties, we will go into some detail about its structure as an example of what we call "living anatomy." All of the spinal column's 186 joints are involved in every movement of the body. This is especially well demonstrated in breathing, which is not generally thought of as a "movement." There are three or four articulations between each vertebra. In the chest region, there are three articulations of each of the twelve thoracic vertebrae with its associated rib. There are functional articulations between the central bodies of the vertebrae as they relate to the disks between them (these are not usually considered true joints, but they do function as joints). Holding patterns can and do occur between any one or (usually) more of these articulations, restricting movement throughout the spinal column *(Fig. 8-5).*

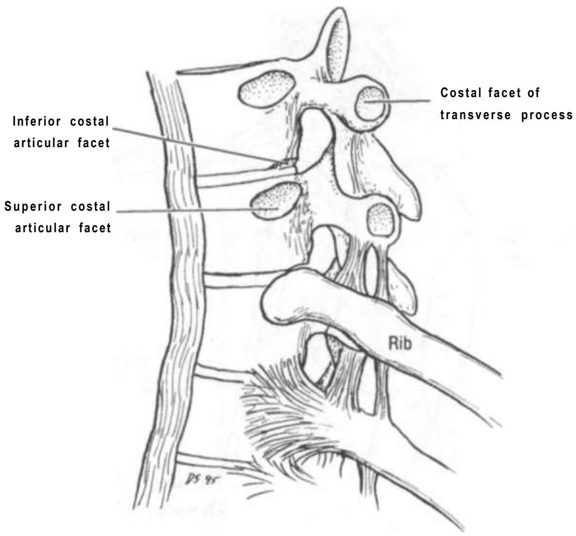


Figure 8-5
In the thorax, the articulations of the ribs with the vertebrae add another level of complexity to spinal mechanics.

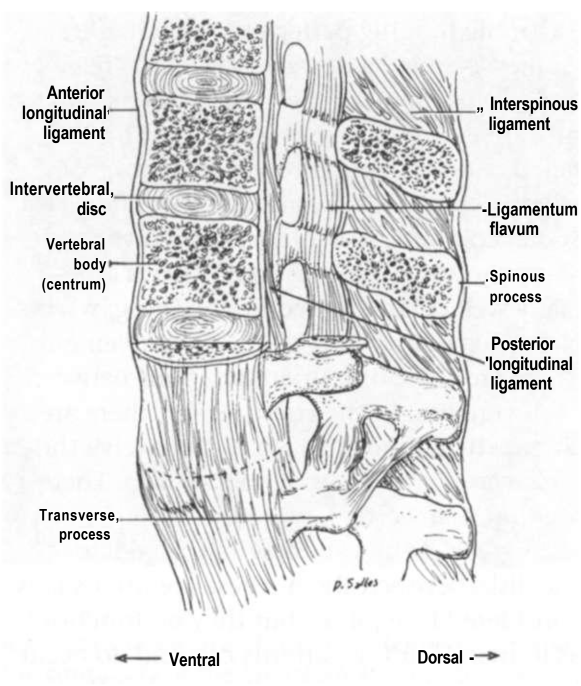


Figure 8-6
Lumbar vertebrae with associated ligaments illustrating the complexity of fiber direction.

We include bone, fascia, and muscle in our definition of a spinal column ***(Fig. 8-6).*** Individual vertebrae must both separate vertically and rotate with every body movement. The spinal column as a whole integrates rotation with lengthening and shortening to allow for diagonal movements. These types of movements are combined to give the spring-like action of the spine that is characteristic of virtually all movement in a truly mobile spine. In dissection, a spiral pattern is visible in the connective tissue around the spine. Movement between individual vertebrae is propagated through this spirally arranged connective tissue into the spine as a whole.

The spinal column is constantly moving in response to breathing, heartbeat, blood circulation, cranial rhythm, etc. For example, when we inhale, there is a tendency for the column to lengthen; spinal curves decrease in angle. When we exhale, the body settles back into its normal curves ***(Fig. 8-7).*** Neither the spine nor the connective tissue that wraps the vertebrae and their associated muscles is ever "at rest."

As movement becomes more active, connective tissue wraps more tightly around the spine. The pattern of connective tissue then goes from a primarily vertical at-ease position

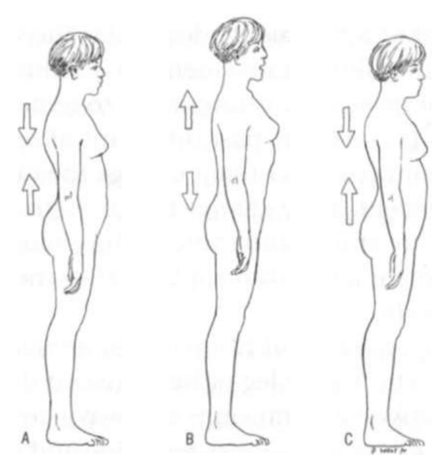


Figure 8-7
Inhale (B) and exhale (C).

to a spiraling, narrower wrapping around the vertebrae and muscles. The action of the muscle fibers is rachet-like, unidirectional, and modular (all or nothing). The action of connective tissue is based on elastic recoil, which is less rigidly patterned. Recoil can be partial, it is multidirectional, and it is propagated in waves. As the connective tissue wraps more closely to the spine, its elastic recoil properties become an increasingly larger proportion of the movement. That is, the more force behind the movement, the greater the involvement of the connective tissue. Gesture then becomes both faster and more integrated (smoother).

The contraction of muscle fiber impels the connective tissue to wrap itself more closely around muscle and vertebrae, paradoxically causing the spine to elongate. As the muscle fiber relaxes, the connective tissue recoils, maintaining and spreading movement through the spine and out into the body. It is this wavelike propagation of movement through the body as a whole that supports continuity of movement and creates movement that is smooth rather than jerky.

The elastic recoil of the connective tissue arises from the arrangement of fibers within the connective tissue matrix. Collagen fibers themselves are not elastic, but they are coiled and their interweaving allows for elastic displacement and return. When these fibers are densely matted or not aligned in the direction of movement, their elastic potential is dispersed. This is the case where there is thickening and bunching of connective tissue. This can be palpated and is sensed as restriction and/or pain.

The physical state of the matrix also plays a role in the ability of the connective tissue to respond to movement. Connective tissue fibers do not exist in a vacuum. They are embedded in a matrix that itself is highly organized. This intercellular matrix is a protein solution. One of the chief properties of protein solutions is their response to changes in temperature—they will be fluid (sol) in warmer temperatures, thick (gel) in colder temperatures. This type of solution is called a colloid; gelatin, for example, is a colloid.

When an area of the body is not stimulated by movement, the underlying chronic muscular tension (holding pattern) cuts off capillary circulation to the area. Blood circulation normally provides heat as well as nutrients and waste removal. As capillary circulation decreases, the colloid matrix changes state from sol to gel, and its consistency becomes more glue-like, trapping connective tissue fibers into a non-moving matted mass. As we have described, fibers proliferate wherever there is tissue stress. The resulting mass of thickened matrix and increased fiber mass can be palpated as an unmoving, painful thickening.

This kind of buildup can be reversed by the intervention of manipulative or movement techniques. The immediate effect is to modify the physical nature of the matrix. The ensuing greater fluidity of matrix gives rise to a changed movement pattern and eventually to a change in fiber density and direction. Manipulation appears to be a faster method of change; intelligent exercise and/or stretching also has the desired effect. In either case, an improved positioning with respect to the gravity line is essential to a change in fiber density.

The connective tissue matrix is an important factor in tissue resilience. Where the matrix is the primary factor in a holding pattern, it can be palpated as a glassy mass. This is one of the most troublesome types of tissue restriction. It is generally close to the bone and is usually difficult to influence toward renewed movement. Some common examples are areas under the shoulder blade or knots just along the spinal vertebrae (at the spinous processes). These are places that are often very sore as well as tight. Other sore places, closer to the body surface, tend to be where large muscle masses cross each other or attach to bone *(Fig. 8-8).*

We describe the concept of joints in more detail later (see Section 22), but it should be mentioned now that between each of the many articulations of the spinal column (as well as in any joint of the body) there is fluid that is similar in composition to the intercellular matrix. As bones articulate, they are not in direct contact with each other. They have fluid between them. Bones "float" in relationship to each other. As the connective tissue compresses around the spinal column, the fluid capsules become longer and thinner, pushing the vertebrae farther apart *(Fig. 8-9).* The spinal column is lengthened by a combination of the narrower coiling of the connective tissue and the pressure of the compressed fluid between bones.

This is a new picture of physical structure. Here the connective tissue is the supportive aspect of the structure. Bones are spacers, serving to position and relate different areas of the connective tissue. Bones are not the supporting structures of the body; the connective tissue serves this function. Muscles, in this model, provide the source and direction of movement energy. Muscles execute movement.

In the classically taught picture of the body, bones are the supporting structures. However, bones do not touch. It is thus impossible for them to support the body the way a table is supported by its legs. Support in a moving structure is very different from support in a static structure, such as a house. Support in a moving structure arises from the organization and arrangement of the connective tissues. When we speak of a movement being supported, we are describing the action of opposing and balanced tissue groups. The reciprocal, balanced planes of connective tissue support both muscle and bone by their elastic capability.

As in the spine, all joints should lengthen with movement as the connective tissue wraps and supports the joint capsule. For this to happen, the connective tissue must be resilient. This resilience is felt as ease; in physiological terms, it is described as tone. An increase in connective tissue resilience is one of the goals of warmup before exercise.

The concept of physical support of movement is simplified if we think in terms of the connective tissue bed rather than in terms of

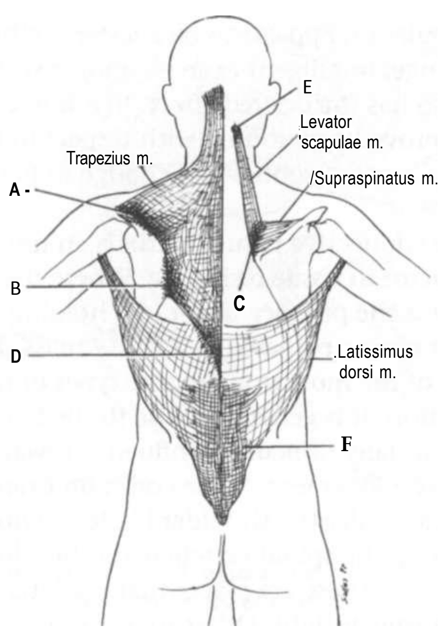


Figure 8-8
These fascial dumpings are the common "sore places" that we complain about.
(A) The trapezius as it crosses the tip of the shoulder (acromion).
(B) The trapezius as it crosses the scapula below the scapular spine.
(C) The interaction of the levator scapulae and the supraspinatus at the upper medial point of the scapula (often especially intractable).
(D) The interaction between the trapezius and latissimus dorsi at about the lumbo-dorsal hinge.
(E) The attachment of the levator scapulae to the base of the occiput.
(F) The pad created by the latissimus dorsi at the lumbosacral junction.

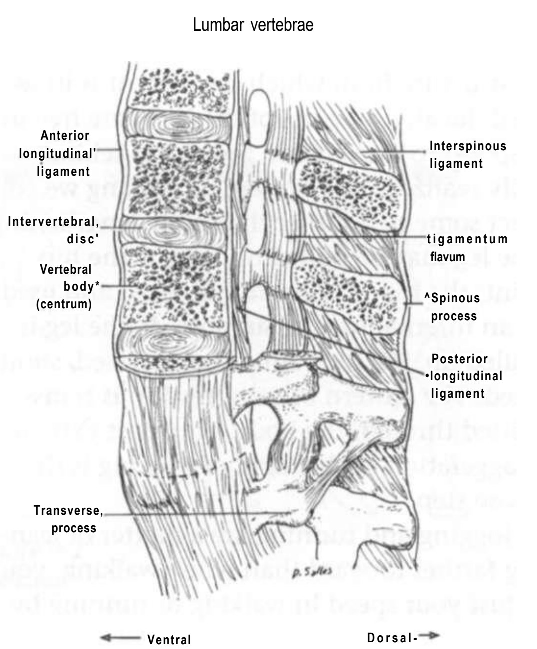
muscle movement. Physical action alters the shape of the connective tissue bed throughout the structure, creating greater change where movement originates and rippling into more attenuated change farther away from the origin of movement. Bones are spacers, like the members of a geodesic dome. A simplified model is a tent, where the tent pole is held upright by the balanced tension between ropes on both sides.

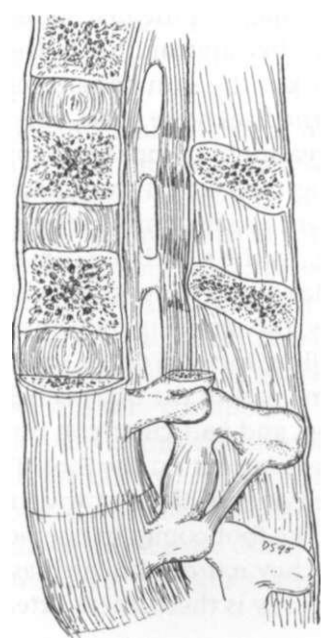
We tend to have an easier time envisioning support from below from a base such as the earth or a chair. Support in a living, moving body comes from above as well as from below. The head and the fingertips are as much a part of the support structure as are the toes. Adequate length in the neck and adequate lift in the head are essential to the movement integrity of the body as a whole.

When the connective tissue bed is not resilient, either generally or locally, holding patterns become habitual. There is a concomitant loss of range of movement and of energy. Many physical therapies address this loss of ability. The Rolfing intervention is the one we know best. By working to enhance the resilience of the connective tissue bed, Rolfing reeducates the body toward an improved relationship to the gravity line.

Both Rolfing and massage might be classified as direct intervention techniques. Shiatsu, acupuncture, and reflexology act by releasing energy through the connective tissue. Other therapies work through retraining movement, either passively (Trager method) or actively, or by a combination of active and passive (Rolfing Movement work, Alexander work, Feldenkrais Functional Integration). Exercise that is properly done also tones and lengthens connective tissue. Some forms of exercise, such as yoga, t'ai chi, and swimming, are by design activators of connective tissue tone. Poorly done exercise and exercising when exhausted, however, have an opposite effect on connective tissue, causing it to harden and contract.

Figure 8-9
The figure to the right shows the lengthening that occurs with spinal movement as connective tissue more closely wraps the joint. Notice that the connective tissue fibers change direction, becoming more vertical as the spinal column elongates.





NINE

Movement and Gravity

When any part of the body moves, the entire body responds. We always move from a base of support. Ideally, when we sit, movement is initiated from the part of the pelvis that is resting on the chair. When moving forward, the pelvis rocks forward, the pubic bone drops slightly toward the sitting surface, and the tailbone is elevated off that surface ***(Fig 9-1).*** The movement is like a spring. It starts at the pelvis and is quickly transmitted through the body up to the head and down to the feet. This falling-forward motion takes only seconds; it is the first part of any forward movement. As forward motion starts, the pelvis widens, however slightly. There is an increase in the space across the sacroiliac junction and a widening at the pubic bone (pubic symphysis). As a result, the hip bones (generally considered relatively immovable) also widen.

In walking, we push off from the ground using the joints in the foot ***(Fig. 9-2).*** This initiates movement in the first split-second; movement is then transmitted to the ankle. Above the ankle, the shin bone comes forward while the heel bone slides backward, thereby increasing the horizontal space in the foot as well as the vertical space between foot and ankle. Once again, this is movement by lengthening. As the shin bone comes forward, the remainder of the body is propelled forward. Ideally, the resulting movement is literally a falling forward of the whole body —unless some part of the body is held back.

In walking, and particularly in running, there is a great impact on the foot. The spaces between the bones of the foot widen and lengthen as the foot comes in contact with the ground; they narrow and arch as the foot lifts up. Not only is there linear extension in the joints of the bones going from heel to toes, there is also widening between the bones of the foot that are side by side. This cushioning of movement acts both to protect the structure and to provide spring for the next step. The spring action comes from the lengthening provided as the connective tissue wraps and extends the joints. The leg becomes longer with movement. This is the result of leaning forward from the base of support, allowing the leg to come forward by lengthening at all of its joints.

The hip joint lengthens as well as widens with movement. Connective tissue wraps the interface between the head of the leg bone (femur) and the hip socket (acetabulum), so that the head of the femur drops slightly out of the socket and downward. This frees the pelvis for two of the three movements characteristic of walking: rocking forward and back and from side to side. (The third movement is swiveling, which results from the freedom of movement between sacrum and ilium).

A base of support is an unmoving surface or structure from which movement is initiated. Ideally, all parts of the body are free to respond to movement. But this is seldom fully realized. More often, in walking we contract some part rather than fully lengthening. The leg may be pulled up against the hip joint; the hip may be immobilized and used as an internal base of support. As the leg is pulled up, the hip joint is compressed, shortened. The pattern of compression is transmitted through the body. The most extreme exaggeration of this kind of walking is the goose step.

Jogging and running are a matter of leaning farther forward than when walking; you adjust your speed in walking or running by how far you lean forward. This is the hardest thing for us to do; we tend to resist letting everything go forward. We bring the shoulders back, the ass back, and/or hang onto our spine in some way, in order to have a feeling of control. A common exaggeration of this is holding the body tensely upright as we walk or run, with the result that the legs are in front of the torso. The body is then literally leaning backward.

In moving with length, as movement is initiated, the joints open (lengthen) spontaneously and sequentially. First the ankle opens. As it reaches the proper limit, the knee joint opens, and so on. Insofar as the joints are free to open, the movement of walking ripples all the way through the body to the head.

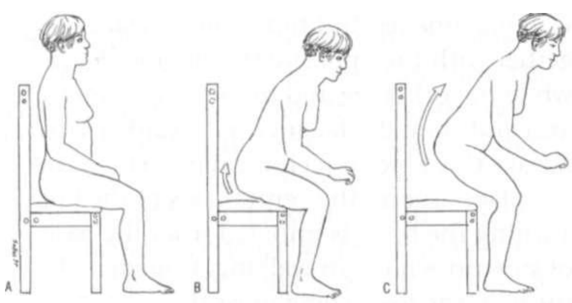


Figure 9-1
Rising

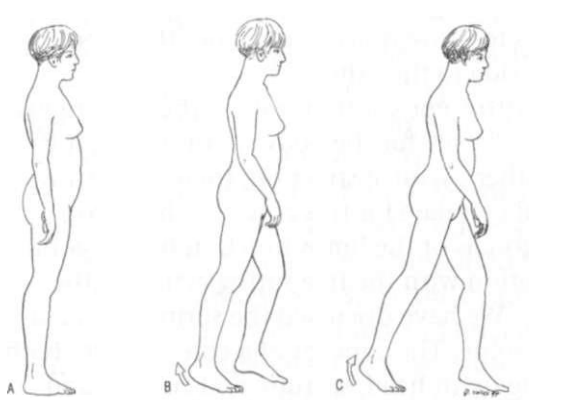


Figure 9-2
Walking.

Many people have a tendency to carry their heads as though they were independent structures. A more workable image is to consider the skull as a great big vertebra sitting on top of the spine. This allows us to visualize how the head can move "in line" with the rest of the spine. When the movement of the spine is like a spring, the head is its last segment. Movement reverberates through the spine and is released through movement of the head. Holding anywhere in the structure reflects most strongly at the ends of the body—between the ankle and heel and between the head and neck. Holding can also originate at the top end. Almost universally, when we think of something or concentrate in any way, we hold our heads rigidly. This holding travels down through the spine and into the legs, resulting in an audibly heavier tread. When thinking (which is most of the time), we come down heavily on our heels.

In day-to-day living, we don't think about movement in anatomical terms. A more accessible concept has to do with controlled/allowed movement. Holding the head rigidly on the neck is control. This kind of rigidity is almost always a response to unconscious fear: we are afraid our head will fall off, we are afraid that we will be so jarred that our head will be seriously disturbed, we're almost afraid our brains will get rattled. When we want to focus on something, most of us automatically feel as though we have to hold still. We are afraid we will lose the image. This happens when we are visualizing internally (looking at the pictures inside our head) as well as when we are seeing externally. It is a misuse of our abilities, yet it is very common.

The other end of this continuum is allowed movement. We can be confident that as we walk our brains will not be rattled. We can be sure that we can see the world in moving pictures. We all are able to see and understand movies even though they show a new frame twenty-four times a second. We don't have to hold each frame still in order to see it. We don't need to control every aspect of our movement; we need to let ourselves move and absorb and let go.

The idea that structure determines function is an old one. Ida Rolf gave expanded meaning to the reverse concept—that function determines structure. Using the connective tissue model, we can elaborate how parts of the body that are analogous structurally (arms and legs) are functionally different. The difference lies in the way the limbs attach to the trunk, reflecting a difference in need and use. In the leg, attachments are primarily for linear tracking. There is the need for the leg to go forward and back and for the joints of the leg to move without excess rotation. In the arm and shoulder, the primary need is for rotation as well as for mobility in all the joints. This is a very different kind of lengthening.

The organization of the connective tissue in the legs therefore needs to be different from that of the arm. In the leg, it is structured for stability; in the arm, it is more elastic for flexibility. The shoulder blade and collarbone ideally float freely in the connective tissue, while the hip bone and leg are more closely knit. In many movements, the arm acts in response to the rest of the body while the legs initiate movement. The t'ai chi concept is that the arms flow like ribbons after movement has been initiated in the legs and pelvis.

We believe that there is a difference in the composition of the connective tissue in the legs and the arms, particularly in structures like the interosseous membranes of the forearm and lower leg. In the arm, the interosseous membrane needs to be elastic so that the bones can rotate with the multidirectional use of the hand. In the lower leg, the interosseous membrane must be denser to support the leg and control rotation between the two bones as the foot moves. The density and arrangement of the fibers as well as the physical nature of the intercellular matrix must be different, to give the necessary difference in compressor ability (resistance to compression).

We exist in gravity—we have weight and we rest on the surface of the Earth. In general, a body's only good choice with respect to gravity is verticality. The concept is, however, merely a useful abstraction. Because the body is constantly moving, there is rarely static verticality.

Bodies also don't move straight forward. Every gesture is on a diagonal, and these diagonals are balanced. It is this balance among cross-movements that creates functional verticality in the moving body. For example, in walking, one leg and hip come forward together with the opposite shoulder and arm while the other leg and hip with the opposite arm and shoulder balance backward. There is always this kind of reciprocal movement taking place around the central axis of the body. Turning the body is initiated from the base of support which, in walking, is mediated through the feet. There must therefore be enough elasticity of action at the ankle joint and between the foot bones to allow not only for bending at the joint but also for rotation so as to move quickly and smoothly from one side to the other.

With some caution, we use the ambiguous word "core" for the body's central axis. It is another useful abstraction; there is no structural correlate for this core. The balanced diagonals of the limbs function best in combination with the free spring action of the core. We have discussed the spring action of the spine. The concept of a core includes both spine (with head, sacrum, and coccyx) and the viscera. There is reason to believe that the connective tissue of the organs is also a part of movement. This can be demonstrated in dissection and is visible in behavior. The viscera themselves, then, also have a spring action that helps to organize movement in the body as a whole.

The literal central axis of the body travels through the viscera, not through the spine ***(Fig. 9-3).*** *A* stomachache, a heart spasm, hemorrhoids, asthma—all deflect the body from verticality as much as or more than a muscle spasm or a rotated vertebra. Functionally, then, the viscera are included in the core structure and are a determinant of verticality.

Even when the primary movement is straight forward, such as walking across an unimpeded floor, the joints of support in the body still need to be free to rotate slightly. The clearest example of this (and the largest rotation in walking in a straight line) is in the connection between the sacrum (the base of the spine) and the two bones of the hip. The sacrum remains relatively stable as the two hip bones rock with each movement of the leg. The movement is almost like a figure eight, absorbing and accommodating the swivel action as one leg and then the next reaches the floor. (Think of Marilyn Monroe on her way across the floor. This is an exaggeration, but it is graphic.)

When we are standing more or less still, if we are in alignment, our weight is comfortable and we need less effort to keep ourselves upright. In standing still, the concept of weight is a good way of analyzing structure. The classic example has to do with the position of the head. If the head is too far forward—that is, if the chin or forehead is leading the rest of the body—then it is not supported by the neck. It is cantilevered. Since the head weighs somewhere between ten and fifteen pounds, we must then use the large muscles in the back of the shoulders and neck literally to hold onto our heads. As soon as the head is moved back into a position where it is centered on and supported by the neck, it becomes functionally lighter. The muscles of the back of the neck and the shoulders can then start to relax.

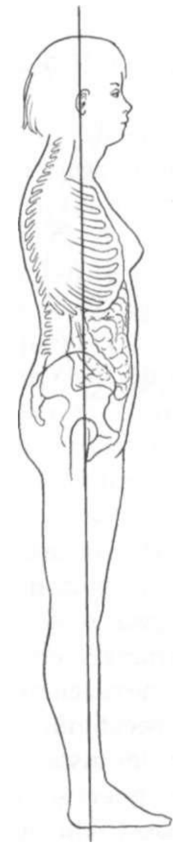


Figure 9-3
Central axis of the body.

The concept of gravity is particularly appropriate to a moving body. The body in motion is still aligned—the head is in line with the shoulders, the shoulders are in line with the abdomen, the abdomen is in line with the pelvis, the pelvis is in line with the knees—no matter how far or in what direction the body leans. The exception is the one leg that is forward to prevent the body from falling. When the leaning body is in alignment, this forward foot is directly under the head ***(Fig. 9-4).*** The support for the head is the forward foot. Gravity then acts through the body in the whole space that it occupies, a broad base between the two feet.

Figure 9-4
Walking.

In looking at the connective tissue arrangement in dissections of human bodies, we noted that there was seldom a linear (vertical or horizontal) arrangement of connective tissue fibers on the surface or deep within the body. The fibers tended to run diagonally across the body. For instance, we saw a heavy concentration of fibers going from one side of the chest across to the opposite side of the abdomen and down to the opposite hip. Fascial crisscrosses seen in dissection seem to relate to the normal rotations in a moving body. When crisscrosses have heavy concentrations of fat and gristle, this is the excessive response of a body that is not in alignment. Many of these padded oblique angles can be seen on the surface of the body. They are usually folds, frequently folds that people refer to as fat that they can't get rid of. But they are actually heavier bands of connective tissue, usually a response to abnormal rotation of the body in movement. In an aligned body, oblique fascial structures are not random. They are necessary for normal movement. The obliques on the front of the body are in balance with those on the back.

Seen from the front, a well-aligned person should approach symmetry, but we are never entirely symmetrical. For one thing, the placement of the organs is asymmetrical. Further, it seems possible that differences in brain function engender asymmetrical movement preferences resulting in structural asymmetry. These normal differences are slight and, ideally, it is possible to visualize horizontal lines through the body.

There is a further measure of proper alignment. This is the relationship of the deep to the more superficial structures, the balance between surface tissue and tissue that is close to the bone. This is visible in the surface contour. Where there is excessive knotting or flabbiness, there is this kind of surface-to-deep tissue imbalance.

When inner and outer structures are in balance, the tissue has what we call proper tone, much the way a violin string that is in perfect tension has perfect pitch. All the words we use to describe tissue tone are subjective—they have to do with personal experience rather than objective standards. Yet good tone is something we all recognize. It is a springiness to the touch and suppleness in movement.

Vertical integrity and good tone are our measures of a properly aligned body. What gets in the way of this ideal structure? For Ida Rolf, the balance of the pelvis was paramount. She felt that every session in Rolfing has as its ultimate goal the creation of better balance in the pelvis. This has to do with the relations of the hip bone (ilium), the sacrum, and the lower back (lumbar) vertebrae. These relations are not simple. Trouble—pain, awkwardness, stiffness, heaviness—is a product of misalignment (rotation) of any one of these elements with respect to another. In the pelvic region, the hip bone can be rotated in its relation to the sacrum or the leg bone. The sacrum can be rotated with respect to the lumbar spine or the tailbone or the hip bone. There may be further rotations between individual lumbar vertebrae.

When we speak of the rotation of bones with respect to each other, we are talking about the "home" position of the bone. This is the position that the bone returns to when it is at rest. In movement terms, the restriction would be noticeable as a loss of range of movement. All of these imbalances between bones are maintained by the soft tissue—muscle, ligament, connective tissue. The discomfort we feel arises from our awareness of soft tissue tension rather than bone imbalance.

Rotation is a combination of tilting and swiveling of body parts, creating imbalances in the vertical and horizontal planes. Here we encounter an interesting difficulty in translating from the visual to the verbal. Seen in profile, excessive pelvic tilt throws off the vertical line. Seen from the front (or the back), a pelvic tilt throws off the horizontal line across the body. Images are two-dimensional; the body is three-dimensional. The combination of vertical and horizontal tilting in the body is what we call rotation, a spiral twist.

There is a welter of terminology used to describe the various types of rotation of the pelvis/sacrum/lumbar spine area. They are precise as diagnostic tools, but unfortunately they tend to confuse the situation for most of us. Diagnosis attempts to identify the most prominent aspect of a problem. We and our doctors say, "I have a lordosis (scoliosis, kyphosis)." But these terms tend to lock the body into a static picture. What we notice so often is that rotations are not static, they don't stay put. For example, the dancer with too concave a lumbar curve in standing will often show an exaggerated convex curve in sitting.

What are these technical terms, and how do they relate to our concept of body alignment? Seen from the side, lordosis is an exaggeration of the normal curves of the spine. (There seems to be no medical terminology for a back that is too flat, even though this can create a lot of mischief.) Seen from the front or back, scoliosis is a sideways S-shaped bend in the spine, which should be more or less straight in this view.

Scoliosis and lordosis are clinical terms that identify spinal exaggerations. In using the terms, we speak as though the imbalance were solely or mostly confined to the spine. But a scoliosis is manifestly an imbalance of the body as a whole. Arms, legs, head, pelvis, and rib cage are all part of the aberration. We can't even say that the spine is what is holding the body in the scoliotic posture. Our experience as Rolfers is that when we release the tissue of arms or legs or rib cage, the spine starts to unwind. Conversely, the spine will not unwind until external structures are given greater range of movement. So we prefer to speak of curvatures of the body as a whole rather than curvatures of the spine.

There are other factors involved in ideal structural vertical and horizontal alignment. For example, if a person with a fairly broad pelvis stands with his feet too close together, he's obviously not going to be in easy balance. He'll have to tighten some part of his body to keep himself upright—grabbing with the toes, locking his knees, tightening the buttocks, and/or contracting the shoulders. If his feet are slightly farther apart, they can balance the broad pelvis. The two legs are functionally a unit, a base for everything above them. Adequate width and depth of the body, as well as free range of motion, are all a part of evaluation of structure.

The human body is obviously an enclosed system. We exist within the circumference of our skin and fascia. The head is the opposite end of a tension line from the feet. Proper length and extension within that circumference allows for adequate tone throughout. This leads us back to the circular concept that we have talked about in reference to other aspects of balance. Cause and effect in the body become interrelated.

TEN

Body Contour

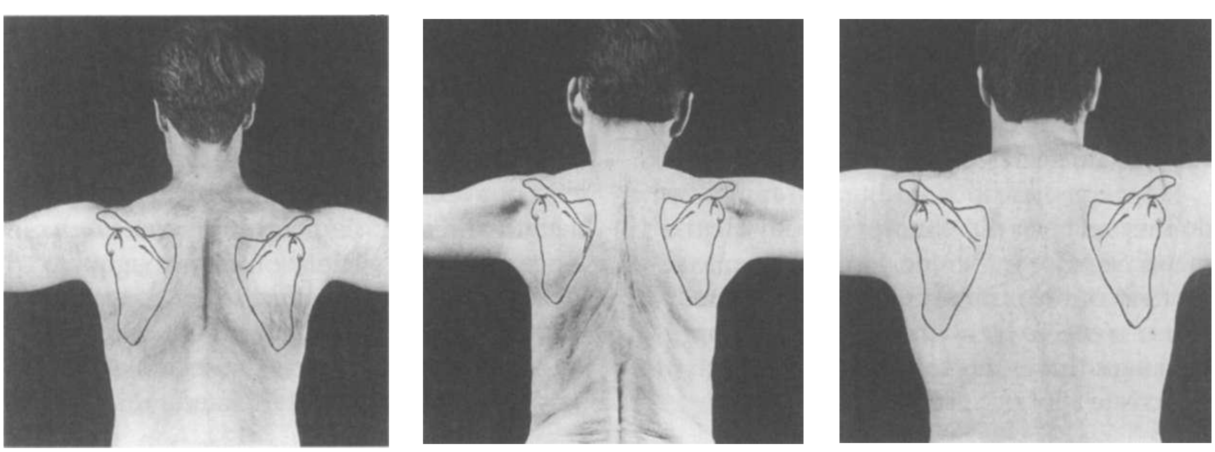
When we look at the contour of the whole body, we can see it as a map of the underlying structures as they affect the connective tissue bed. Muscles expand and contract in response to demand. Habits lay down pads, sometimes containing fatty accumulations. The position of bones within muscle and connective tissue controls the direction of movement. Volition, habit, and self-image shape the connective tissue, which in turn supports and restricts the activity of muscle, bone, and other functions such as circulation, breathing, and digestion. The result is a person's shape.

The contour of the body is based on connective tissue. As it interacts with bones and muscles, these soft tissues are the primary determinant of body shape. This is in contrast to the usual artist's conception of muscle anatomy as determining the outline of the body. Body shape is therefore affected by the holding patterns that we have described.

Figure 10-1
Body contour tells us a lot about the condition of the underlying connective tissue and its potential for movement. Here are photographs of three very different body types. Intuitively we have expectations of how these bodies will move.

A photograph of a body shows shadows and highlights that can be seen as hills and valleys ***(Fig. 10-1).*** There are areas where the tissue bulges and areas where it appears to be held deep. Highlights (hills) correspond to thickened pads of tissue between skin and bone (and/or muscle). These pads are often made up of fatty tissue in association with fibrous connective tissue. The shadows (valleys) appear to be areas where skin almost sticks to bone (and/or muscle). What is creating these adhesions seems to be a compacted bed of collagen fibers mixed with intercellular matrix in its gel state.

Both of these modifiers of contour reflect the way the body is used. Heavy fat and connective tissue pads are visible in areas that have been under tension for a lifetime. Two pads that are present in almost all bodies are a very heavy thickening at the base of the skull and a heavy pad at the base of the spine, over the top of the buttocks ***(Fig. 10-2).*** Muscles are overused in these two areas. The large, broad muscle at the base of the skull (trapezius) is in constant partial contraction to support a forward head. The upper margin of the gluteus maximus habitually contracts to hold



the pelvis rigid. Chronic tension has resulted in a heavy pad on the body surface.

Indentations are likewise visible in areas that have been under tension for a lifetime. The bone appears to be right at the indented surface, just under the skin. Actually, the bone lies under several layers of toughened connective tissue. The skin sticks to the leathery (or glassy) connective tissue. On the other hand, where the connective tissue layer over bone is in good tone, the skin can move freely over bone and tissue. We never actually touch bone in palpating the body. There is always a connective tissue layer of greater or lesser complexity beneath the skin.

Contour is idiosyncratic even at birth. In a detailed dissection on two stillborn infants, there was a considerable difference in muscle development. In one, the musculature of the body was relatively undeveloped, while in the other the pattern was well defined and visible

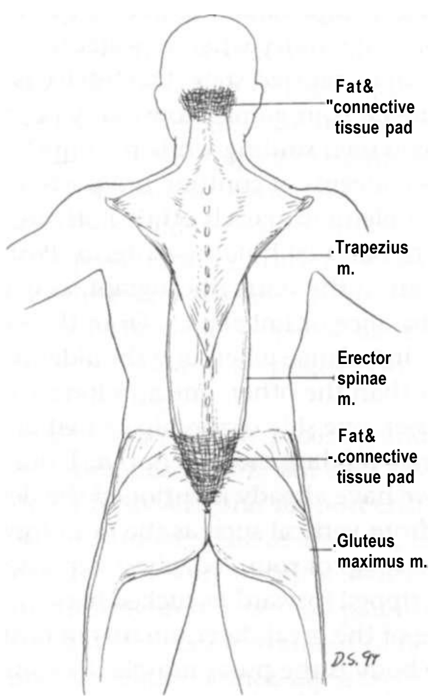


Figure 10-2
Fat and connective tissue pads.

Figure 10-3
This is a photograph of a dissection of a stillborn baby at term. The heavy pad of fat over the gluteal region was a thick mass of connective tissue containing fat. Note the similar padding across the shoulders and up into the neck.

down to the tiniest muscle. However, the patterns of connective tissue padding in the two babies were in many ways similar *(Fig. 10-3).* In both, there was a heavy pad of fibrous connective tissue across the upper posterior border of the large hip bones, crossing over and tying the hip bones to the sacrum. There were also pads of fatty connective tissue between the legs (between the region of the anus and the genitals). These pads were thick, somewhat like a diaper beneath the skin. The presence of this padding at birth would indicate that it is a normal part of body contour. It is only when it is overdeveloped and thickened that it becomes a problem.

We tend to think that heavy muscle is good and that the more a muscle is developed, the better off we are. Overdeveloped muscles look impressive, but they tend to reduce free range of movement. This is because the pumped muscle is contracted, resulting in compression and shortening at the joints. For balance, a heavy muscle needs another equally heavy muscle to offset its contractiveness. Where there has been more persistent effort at muscle building on one side of the joint than the other, the joint torques (twists).

A bodybuilder who conscientiously works on all of the muscles can achieve a balance of tightness around individual joints. This balance is based on partial contraction; it will be functional as long as the program of exercise is maintained. But when such a person walks, he or she ends up with a kind of waddle. The leg is not able to lengthen out of the joint and therefore cannot move straight forward and backward ***(Fig. 10-4).*** Where bodybuilding is combined with stretching and body awareness (e.g. yoga), it is sometimes possible to maintain adequate freedom of movement in the joints along with development of the muscle mass.

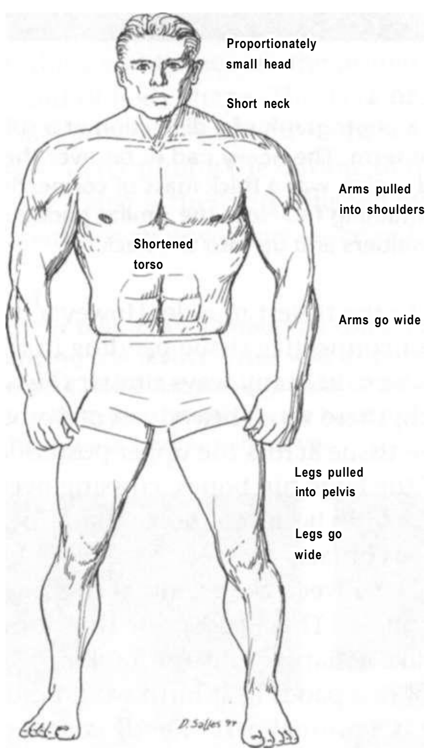


Figure 10-4
The muscle development of this body looks impressive, but that muscle bulk is a major impediment to freedom of movement.

A reasonable amount of bodybuilding is a good thing, creating tone and strength. Too much of a good thing in this case causes restriction and exacerbates preexisting habitual distortions. Excessive demand on a body part always brings out whatever compensations or restrictions already exist in the part. This is true for pumping iron, working out on machines, running or jogging, or ballet. Unless there is modification of the exercise to accommodate individual idiosyncrasies, there will eventually be problems. In addition, challenging workouts are generally associated with exercising past the point of efficiency. This is where most of the mischief occurs. It is virtually impossible not to create chronic and/or acute injury when repeatedly exercising in an exhausted state. Our advice is to let pleasure be your guide. How many people have you seen smiling while running?

The concepts of contour and posture overlap and blend into each other. Both are the result of habitual holding patterns. Posture is apparent in the static photograph as overall body balance or imbalance. From the front, we see imbalance when one shoulder is higher than the other, one arm longer than the other, one side of the hip canted upward, one knee tending more in or out. From the side, we have already mentioned the deviations from vertical such as the head forward, shoulders up or rounded, chest depressed, pelvis tipped forward or tucked back.

One of the great determinants of posture in the body is the psoas muscle. Its connective tissue ramifications are especially important. The psoas myofascia is interwoven with the fascia of the muscles on the inside of the pelvis as well as with the diaphragm fascia. In the groin area, just to the side of the pubic bone, the direction of the psoas changes. This allows it to act as a kind of pulley. The psoas tendon attaches to the femur at the top of the inner thigh and is thus commonly bound up with the fascia of the longer muscles going down the leg.

When the psoas is habitually contracted, all kinds of postural and functional difficulties can arise. The psoas can be too short, too wide, too narrow, too flaccid. Moreover, even though centrally located in the body, it is a bilateral muscle. The two sides are rarely symmetrical in tone, placement, and size. A physically asymmetrical psoas then leads to lumbar rotations and pelvic tilts ***(Fig. 10-5).***

According to Ida Rolf, the psoas is one of the most significant muscles of the body. It maintains body structure and body relationships ***(Fig. 10-6A and 6B).*** The psoas originates along the upper lumbar spine; for part of its length it runs along the front surface of the lumbar vertebrae. Its origin is in close proximity to the two tabs of the diaphragm called the crura; through these neighbors, the psoas can involve the respiratory pattern. It diagonally traverses the cavity of the pelvis, and inserts by a tendon shared with the iliacus (the iliopsoas tendon) into the lesser trochanter of the femur. The iliacus lines the ilium, the large bone of the pelvic basin. Structurally, the psoas is a bridge between upper body and legs.

"If a body is normal, the psoas should elongate during flexion and fall back toward the spine. This prevertebral support ensures length in the lumbar spine as a whole, irrespective of general body position. With the psoas functioning in this normal pattern, lengthening with every movement of flexion, the lumbar vertebrae cannot slip into the compression and misalignment that is the beginning of the bad lower back. A deteriorated psoas, glued down as it crosses the pelvic brim, chronically flexes the body at the level of the groin, so that it prevents truly erect posture."*

The preferences of the psoas are not obvious at birth. They start to show when the legs adjust to bearing weight, as the child crawls and starts to stand up. Nevertheless, muscular imbalances do exist in the neonate. As we have said, children are born with more developed muscle in back than in front. At about a year old, in order to walk, the child has somehow to solve the problem inherent in this muscular and connective tissue imbalance. One fairly common solution is to overuse the psoas, pulling the lumbar vertebrae forward. This is the origin of the typical big-bellied baby look.

Immature body patterns frequently persist

*Ida P. Rolf, *Rolftng: The Integration of Human Structures* (New York: Harper & Row, 1977), p. 110.

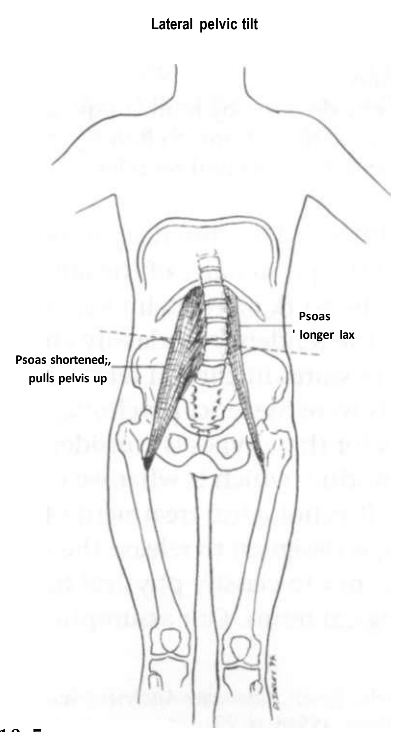


Figure 10-5
A physically asymmetrical psoas leads to lumbar rotations and pelvic tilts.

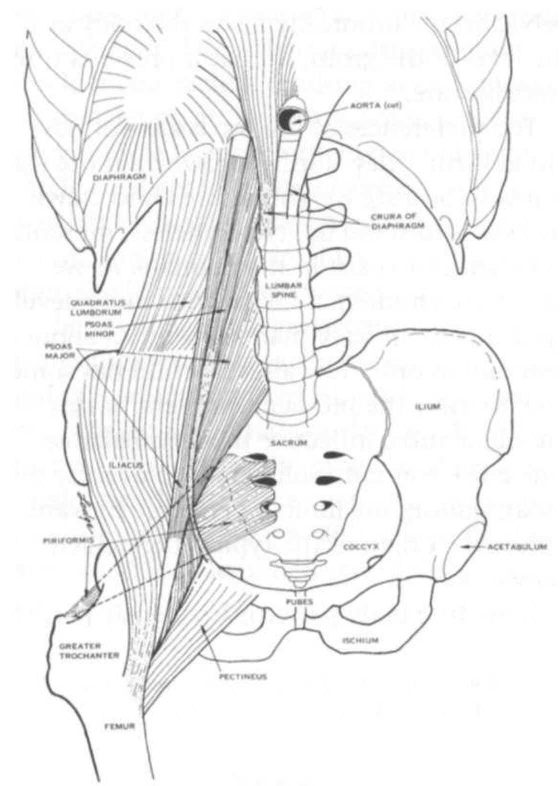


Figure 10-6A
This masterly drawing by John Lodge has been taken from Ida Rolf's book on Rolfing. It shows the iliopsoas and its associated muscles.

into adulthood. They intensify to pervade the body and the personality of the adult. Starting with the work of Wilhelm Reich,* there has been the tendency to classify characteristic body postures in clinical terms. Reich classifications were hysteric, psychotic, schizoid. The basis for these types is considered to be body armoring, which is what we call holding patterns. Psychological treatment of character armoring is designed to release these patterns. We prefer not to classify physical habits in psychological terms. Our assumption is that the psychological pattern tends to change as the physical structure is able to evolve.

On the other hand, physical culture experts attempt to modify structural patterns by building up muscle mass. A familiar example are all those exercises designed to "tighten the tummy." It is our contention that it is not effective to shorten the belly muscles to match the tight back muscles. We believe that no amount of sit-ups will improve a structure whose key is a compulsively tilted pelvis. Moreover, no physical problem exists in isolation, so we cannot ameliorate structure by focusing on one symptom. For example, there are two typical holding patterns reinforcing a belly that sticks out. One is a depression of the rib arch (costal arch). The other is an immobility at the groin (inguinal) region. These start to develop in the small child. They too are exacerbated as the child starts to walk. Both of these patterns would be reinforced rather than corrected with improper sit-ups.

Another example of a common postural set is focused at the base of the neck (seventh cervical vertebra). At its extreme, the head is pushed very far forward. The shoulder blades are so high that it almost looks as though they are pushing the head forward, cantilevering it out over the chest. A variation of this pattern is often seen in older women and men. The "dowager's hump" is the result of creating an excessive pad at the base of the neck.

Like the folds of a curtain, when the head is forward, everything in the body appears to hang from the base of the neck. There is no way this posture can be corrected by simply "holding your head up." It is too hard to hold your head up; you will stop the effort as soon as your attention is deflected from bettering your posture. To get the neck straight, you must exert constant effort to pull against depressed ribs and collarbone. You must push

*See Wiilhelm Reich, *Character Analysis* (New York: Noonday Press, 1990), p. 72.

against hunched or rounded shoulder blades. Even assuming you could do all that, there are further holding patterns all the way down to the feet.

Rolfers have been talking about the way people use their structures inefficiently, squandering their energies and working against themselves. How can an efficient body be described? Rolfers like to talk in terms of vertical and horizontal planes. They evaluate the body in terms of the logic of mechanics and draw lines through the body in the mind's eye. The total body tissue—bone, muscle, and especially connective tissue—acts together to create the structure that gives these imaginary lines. These lines are more apparent in a body that is still, but body workers learn to evaluate the underlying structure of a moving body.

The goal, then, is not so much to achieve perfect vertical and horizontal structure lines in a body. Rather it is to free the soft tissues so that the body can move freely by balancing through planes that are horizontal and vertical. Our goal is to have joints move as though they were in line.

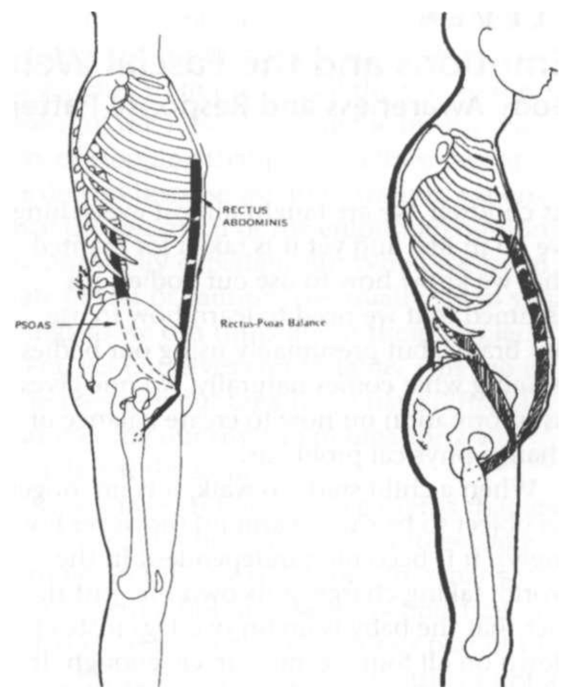


Figure 10-6B
A chronically short psoas will have its greatest impact on the groin, forcing the pelvis down in front. There is a concurrent loosening of the normal tone of the rectus abdominis. One very common result is lordosis and a pot belly.

ELEVEN

Emotions and the Fascial Web

Body Awareness and Response Patterns

As children, we are taught almost everything we do in life, and yet it is taken for granted that we know how to use our bodies. It's assumed that we need to learn how to use our brains, but presumably using our bodies is doing what comes naturally. No one gives us information on how to create balance or change physical problems.

When a child starts to walk, it is no longer an object to be carried around (however lovingly). It is becoming independent in the world, taking charge of its own life. Just the fact that the baby is up on two legs instead of down on all fours seems miracle enough. It would be gilding the lily to try to instill form, even though this would be the best time to show a child how to use its legs.

Imagine, for a moment, a baby's first steps. There is unsteadiness in the feet and legs, accompanied by attempts at balancing with the arms. When the baby was crawling on all fours, security lay in keeping the back steady and pushing off with the hands and knees. When there is unsteadiness in walking, the baby again attempts to control with arms and knees and by holding the spine rigid. When adults hold a child to help it walk, they generally hold under the armpits or by the hands. This again reinforces the pattern of controlled shoulders to stabilize walking. This persists as the holding pattern of the adult ***(Fig. 11-1).***

Most holding patterns are related to emotional fear, lack of trust. Reasonable caution and attempts at control by the infant as it learns to walk can be retained as movement patterns in the adult. The adult is not afraid of losing balance and falling, but as the adult walks, he/she unconsciously restimulates those early fears. In William James' famous dictum, "I don't run because I am afraid; I am afraid because I run."

Movement patterns express personality patterns as well as vice versa. Fear manifests as a general characteristic in all aspects of the individual's identity—in body, emotion, energy, mind. The true nature of fear (lack of trust) is that it is a signal to pay attention. Yet we habitually misinterpret it as a signal to fight or flight. Even in the case of a body part that hurts when it is moved, fear is more appropriately a signal for caution. It should not cause us automatically to tighten that area. The more we tighten it, the more it will hurt. This "natural" reaction has an outcome that is the reverse of our intention. The fear of being unsteady precipitates all sorts of unconscious modifications—locked neck, grabbed toes, sucked-in ass, held shoulders, clenched jaws. These are all in response to our fear of being unable to control our movement or are done to avoid ridicule or embarrassment.

Integrated movement centers around the concept of leaning forward so that gravity rather than effort initiates action. For many people, the suggestion to lean or fall forward, instead of creating a relaxation response, starts a process of tightening in the body. The result is a grabbing point (or several). This holding is unnecessary. The whole body can be in a fluid state at all times. The reason someone doesn't allow himself to "fall" forward into movement is that he doesn't trust his structure.

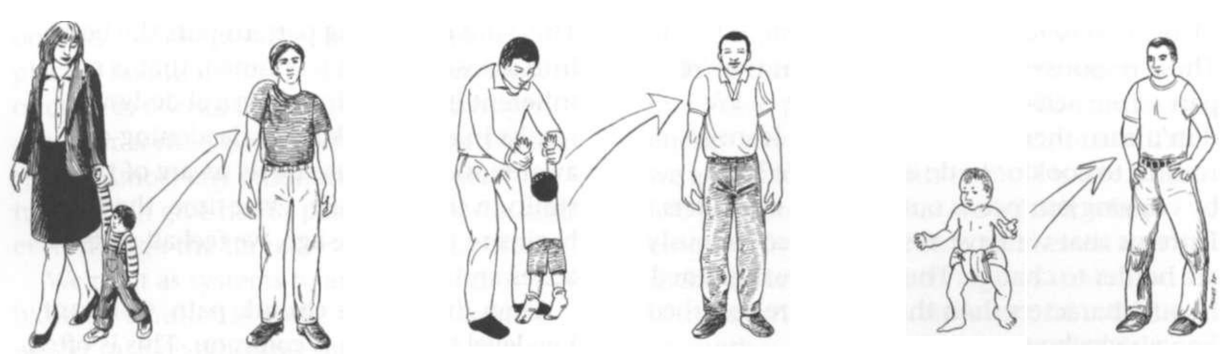
Often this lack of trust starts with a rational fear. When we are small and learning to walk too early, we can't lengthen the joints to the point where leaning forward is comfortable. The child finds some way to pull its balance back. Later, in the adult, the same kind of reaction persists. This is particularly evident in sports. In skiing, for example, it is essential to lean forward. There is more control in the tips of the skis, more lift in turning, and less chance of falling down on steep or bumpy slopes. There is also more mobility because of a greater control in the knees. Most beginning or intermediate skiers, however, do not lean forward. When they fall, they generally fall backward. They sit down. This is the reaction we taught ourselves in childhood. The after-the-fact explanation is that we are afraid to fall forward because we're afraid we might hit our heads. Not true. We're much more likely to fall forward onto hands and knees.

We're not taught to walk as children, and we're not taught to breathe. The most common tendency of anyone frightened is to hold his or her breath. An example is jumping into cold water. With the initial shock of the cold, our tendency is to gasp, to draw the breath into the lungs and to hold it there. The whole body tightens and is unable to adjust to the coldness of the water. Letting the breath out allows the body to relax; the water no longer feels as cold. Similarly, when we experience physical pain, gasping and holding the breath are common, but they only serve to retain pain.

Ideally, any physical sensation can be experienced through the body the way a shiver goes from the feet all the way to the crown of the head. Holding the breath is a way of stopping that physical flow. Perhaps we do this because we don't want to experience the sensation or the emotion (emotions are physically experienced). When we are in a state of fear or caution, we usually try to stop things so we can think about them, explain them, get ourselves comfortable. This too is when we stop our breath; we have difficulty maintaining our rhythm of breathing and thinking at the same time.

As we have said, response patterns that are repetitive and unconscious tend to become chronic. In the case of the breath, what we see is a partial holding. Many people have a stored reservoir of air in the lower part of the chest; the lower ribs move very little or not at all. As a result, there is a tendency to barrel or round out in the lower chest. A second area where there is little breath activity is in the upper tip of the lungs. The ribs just under the collar bones and high up inside the armpit are unexplored territory—most of us do not feel or move these topmost ribs. The tips of the lungs extend up to this region, so we should be able to move these ribs freely with every breath. Being restricted at the top and the bottom of the rib cage, we rarely experience a full breath.

Figure 11-1



One way to establish a full breath is to concentrate on the exhale. As you come to the end of your usual exhale, allow more air to leave the lungs. This does not mean pushing the air out with the abdomen, but rather allowing the rib cage to relax, especially the topmost and lowest ribs. Put your hands on your lower ribs just above the abdomen. Feel the movement of these ribs as you breathe, concentrating on the exhale. The exhale becomes the active part of the breathing cycle; the inhale occurs spontaneously.

Holding the breath is a pattern most of us use to ward off unwanted feelings. To some extent, we are taught to hide emotion. For example, exasperated parents sometimes do almost anything to stop their children from crying. The crying may be reasonable. For one thing, it is a very good way of letting all the air out of the lungs, and it is also a way of letting a physical problem work through the body. When a child has to stop its crying, it must tighten or cringe—tense up. Another common message to children is to stop that feeling, stop that activity, stop that noise. When a child must stop doing something, arrest its momentum, its only recourse is to hold some part of its body—its breath or back or jaw. This is the moment (in a child or adult) when the emotion gets stored in the connective tissue.

Usually we don't know that we're holding our breath, any more than we know when we make other habitual gestures. They're unconscious, and as Jung says in his *Collected Works,* "The unconscious is really unconscious." These responses are so habitual that they're part of our self-image, part of what is. We don't learn them the same way we learn to read or to cook or to do algebra. We learn by copying our peers, our siblings, our elders. Patterns that we have absorbed unconsciously are harder to change. They are more ingrained in our characters than those that are absorbed knowingly, by conscious learning.

Evaluating bodies, we tend to focus on the physical things that have gone wrong—illnesses, accidents, ways we got pushed out of shape. This is a habit, a point of view, an attitude that is shared by most people. In general, we tend to take notice only when we're hurt. I know about my ankle because that little twinge reminds me that I need to be careful of it. I think about my shoulder because it catches every time I move my arm in a certain way.

Pain is one way the body communicates to us. We have other kinds of physical awareness, but they too are usually negative—we have portions of our bodies that we don't like. This is a different kind of communication. One is a direct message in terms of pain or sensation; the other is an emotional message, a judgment.

When something hurts, we first check to be sure that nothing is injured or broken. If there is no injury, we try to put the pain out of mind. In a way, this is life supportive. If my ankle hurts and that's all I think about, I'm not going to get much done. But there is a problem. If I shut off sensation in my ankle so I don't feel pain, I shut out other sensations from my ankle as well. Now I have a body image that doesn't include my ankle, perhaps doesn't include my hip, and so forth. My sense of vitality is diminished. The same kind of process occurs with respect to emotional pain.

People hunch their shoulders or hold them back in response to being told not to slump. This kind of holding pattern puts the body into a position that is strained, that is not inherent in its original physical design. It results in a similar kind of deadening of awareness. People are rarely aware of the strain in their posture. Over time, the strain begins to tell. As we age, we feel all sorts of aches and creaks.

Then there is the chronic pain. Constant low-level back pain is common. This is often the result of a precept taught to the very young that little boys (and girls) don't wiggle their rear ends. Even when the holding pattern has originated in the child, the awareness of restriction and pain can start at any age. These restrictions arise from general attitudes in the culture. There are also individual kinds of contraction and holding.

(A personal note from one author: "Once, for example, when I was walking up one of the steep streets in San Francisco, my knee started to twinge. Soon the pain was so severe that I felt I wouldn't be able to reach the next street corner. Nor could I find a convenient place to sit down. And then I suddenly realized that in the tension of the climb and trying to get where I was going in a hurry, I had been holding my jaw clamped. When I let my jaw relax, the knee pain went away and I was able to get up the hill." A movement connection between jaw and knee seems obscure, but there it was. It is an example of the common phenomenon of how movement at one end of the body constrains the other end, even though the rationale behind the connection is not clear at the moment.)

The sensation of pain is a signal that something is going on that isn't right. The more we're unaware of our bodies, the more we need a guide to let us know how and where things need to get back to true. Unfortunately, we usually think of pain as the cause of the problem. Then the "logical" response is to try to get rid of the pain. The area that hurts is not necessarily the cause of the pain; the body as a whole is out of balance and one place is taking the brunt of the strain. Most of us have a weak link, a place that twinges, aches, or contracts whenever we experience stress. Almost any emotional or physical trauma will give rise to pain in this stress site, even though the trauma is not to that area.

We react as systems to any situation. A blow, an emotional upset, whatever trouble we get into reverberates through the organism as a whole. It simply gets stuck at our weak link; this stoppage is the sensation of pain. The cause, the initial event, is often unrelated. For example, if you break a leg or sprain an ankle, compensation sets in at the hip and back to favor that leg. Any future pain or problem in the leg, unrelated to the original accident, reinforces the initial compensatory habit. In time it is impossible to determine which is cause and which is effect. It is more accurate to describe physical problems in terms of areas of acute or less acute sensation.

Physical and emotional awareness are connected. We feel emotions physically. Imagine, for example, the characteristic shiver that is fear. A variation of this is the delighted thrill of terror in a horror movie or on a roller coaster. It is probably true that the physical manifestation of emotion is a secondary phenomenon, a response to the actual emotion. And yet this response, this expression of the emotional impulse, is part and parcel of the emotion itself. Human beings seem to be feedback systems. There is an initial germ of awareness. It is expressed intellectually, emotionally, physically, or all three, and this then feeds back into the system to be enhanced, muted, redirected, etc.

The physical response to emotion is through the soft tissue. The fascia is the emotional body. That's a metaphysical concept; we could call it meta-anatomy. Ideally, feelings are felt in the total body—emotions travel through the fascial web. We then interpret the physiological sensation as anger, affection, love, interest, and so forth.

Proprioception is the ability to sense one's own physical being. Emotion and energy also have a physical component that we are including in this term. It is this physical proprioception that we inhibit when emotion or energy or structural events are inconvenient. One such type of inhibition is transferring awareness from one modality to another. For example, people who do not wish to recognize that they have an emotional pain frequently transform it into physical pain, as in a tension headache.

Our goal is to clarify that which is physical and to allow that which is emotional to be seen as such. It is always easier to deal with a situation in its own modality. Physical pain, for example, is what you feel when you break your arm. It is not appropriate to try to deal with a broken arm in terms of your resentment at the person who pushed you.

On the other hand, the reason your neck can't straighten and lengthen may be because of the shock of being continually bullied in childhood. Physical work will only partially open that problem unless there is recognition that there may be an emotional origin. When we can see emotional situations clearly, we are then in a position to move through and away from them.

What makes the pain seem physical is that it does include a structural component. An emotionally held part of the body becomes rigid after being held tightly over years. Shoulders that are hunched from fear are difficult to distinguish from shoulders that are hunched after a bad fall. Both have become a part of the structure and part of the physical makeup of the body. Conversely, it is hard not to experience a mixture of depression and anxiety when a bad back or a chronic headache flares up.

Physical and emotional sensations overlap and influence each other. It is important to distinguish them in terms of a choice of therapy. In the example of the broken arm, there is a lingering fear (emotion) that the arm is fragile. In physical fact, the healed break has made the arm stronger; all that remains is to let go of the emotion and move the arm freely.

We have shown how a body functions and some of the history of it's growth. We have "fleshed out" the concept of a connective tissue body and given images and descriptions of how this concept came into being and how it works itself out in an actual physical body. In the next section, we use that informed perception to look at and analyze body contour.

PART THREE

Body Retinaculae (Bands/Straps)

TWELVE
The Chest Band
Implications for Movement and Behavior

In order to feel alive and comfortable, we need free flow, whether we call it a free flow of energy or of movement. This freedom is visible physically in body contour: it is possible to infer from someone's shape the state of his or her energy and ease of movement.

The most obvious aspect of the body is proportion. An example is the balance between the top and bottom halves of the body. We often say that a man's head is too small for his shoulders, that a woman's hips are too wide, that a kid's legs are too skinny. A sense of proportion is a matter of aesthetic judgment; standards vary from one culture to another.

Aesthetic proportion is one way of interpreting body contour. A silhouette outline shows the hills and valleys of the body. The hills refer to bulges and the valleys to tight places where surface tissue appears stuck to underlying tissue. Theoretically, an ideal body has a more or less smooth contour. When muscles are not being used, they should be able to relax and thus create no marked bulging. Muscles contract and thicken as they are used; as they relax, the area flattens. In an area that does not flatten, there are often accumulations of connective tissue and fat that have become cemented into place over the muscle tissue.

Besides individual variations in contour, there are also patterns that are more or less common to all bodies. These patterns appear as straps—bands that we see running horizontally around the body, almost like retaining belts holding in the soft tissue ***(Figs. 12-1 & 12-2).*** These are relatively independent of the muscle anatomy of the body. They are unexpected and unexplained, but they are visible soft tissue structures. The contour patterns we discuss in this section are a series of seven such bands. As we describe these individually, we talk more about what they imply about both movement and behavior.

Straps represent a functional connecting structure through the body where there are no traditional anatomical connections from front to back. We describe the straps as being just under the skin because that is where we see them. As the body moves, they seem, however, to go all the way through as well as around the surface. They may be visualized as planes through the body.

These straps on the surface of the body are similar in function to the armor of an armadillo. The segmentation of the armor holds each part rigid with respect to its neighboring section while nevertheless permitting some movement. Similarly, in the human body, the straps preserve external structure, preventing too deep an infolding as the body bends. To some degree, this is probably an effective way of shoring ourselves up. It is a pattern we see in all human beings.

Straps seem to arise in much the same way as tendons and ligaments, which they appear to resemble in structure. The telltale sign of the presence of a strap is a flattening or depression running horizontally through the body surface. It may be continuous or interrupted—like a dotted line. What defines these as restrictive bands is their inflexibility; they break the flow of movement.

The most obvious strap, evident in almost everyone, is a horizontal depression in mid-chest, just below the nipples. Seen from the front, this is located at the junction of the upper insertion of the rectus abdominis

Figure 12-1
Body Retinaculae: The Seven Body Bands of the Torso

1. The lowest band in the torso (pubic band) extends from the pubic bone in front across the groin (which is thereby shortened), around the hip bones (the greater trochanter of the femur), and across the buttocks, ending at the junction of the sacrum and coccyx.

2. The band across the lower abdomen (inguinal band) is frequently more prominent in men. It connects the two bony projections of the pelvic bones in front (the anterior superior spines of the ilia). It usually dips slightly downward in front, like an inverted arch, resembling an internal jock strap or chastity belt. Its lower margin tends to include the inguinal ligament, connecting the band downward to the region of the pubic bone. This band extends laterally along the upper margin of the large wings of the pelvic bones (ilia), ending at the lumbosacral junction.

3. The third band crosses the abdomen (belly/umbilical band) and is perhaps the most variable in location. It may cross at the umbilicus (sometimes creating a crease in the abdominal wall extending out on either side of the umbilicus), or it may lie midway between the umbilicus and the midcostal arch (tying together the two sides of the costal arch). In either case, it will extend laterally to form an arch across the abdomen to the lower ribs on each side—particularly to the free tip of the eleventh rib. It travels backward along the lower ribs, ending at the junction of the thoracic and lumbar vertebrae.

4. The fourth band is in the area just below the nipples (chest band) and is visually the most apparent. It is usually a non-moving depressed area on the chest; the skin seems glued down onto the ribs and muscle. Laterally, it extends along the lower border of the pectoralis major, across the mid-lateral chest, and down the lateral margin of the latissimus dorsi where it begins to run parallel to the scapula toward the arm. The strap appears to tie the lower tip of the scapula to the back ribs and ends at the dorsal hinge of the spine. When this strap is pronounced, there is not only a depressed midchest, but an inability to expand the ribs sideways in breathing.

5. The fifth strap at the shoulders (collar band) involves the clavicle and is part of the tissue gluing the clavicle to the first and second ribs in front. It can be felt as a pad of tissue just below and deep to the collar bone (clavicle). It extends laterally to the tip of the shoulder, with some fibers fanning down into the armpit. The strap continues toward the back on the inside and outside of the upper border of the shoulder blade (scapula), and ends at the junction of cervical and thoracic vertebrae.

6. The area below the chin (chin band) is an area of concentration of fibers and padding which includes the hyoid bone and the base of the jaw, passing just below the ear, and ending where the base of the skull joins the first cervical vertebra (atlas).

7. The top band (eye band) is the most difficult to visualize. It originates on the bridge of the nose, travels across the eye sockets and above the ears, and ends at the back of the skull just above the occipital crest (the bump at the back of the skull).

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NOTE: For the body retinaculae, we have used the terms "band" and "strap" interchangeably.

muscle and the lower insertion of the pectoralis major muscle ***(Fig. 12-3).*** The band is slightly higher as it moves around to the back because the ribs characteristically are angled downward in front. The back extension of this strap seems to be the dorsal hinge, a functional division of the chest (thorax). The dorsal hinge is visible as a change in movement pattern between upper and lower halves of the chest, hinging between the fifth and sixth (or sixth and seventh) thoracic vertebrae. This division of the rib cage into two parts was apparent in our dissections. The angle of the ribs changed visibly and relatively abruptly; the quality of the tissue differed as well.

In front, the strap starts about an inch above the lower tip of the sternum. This also

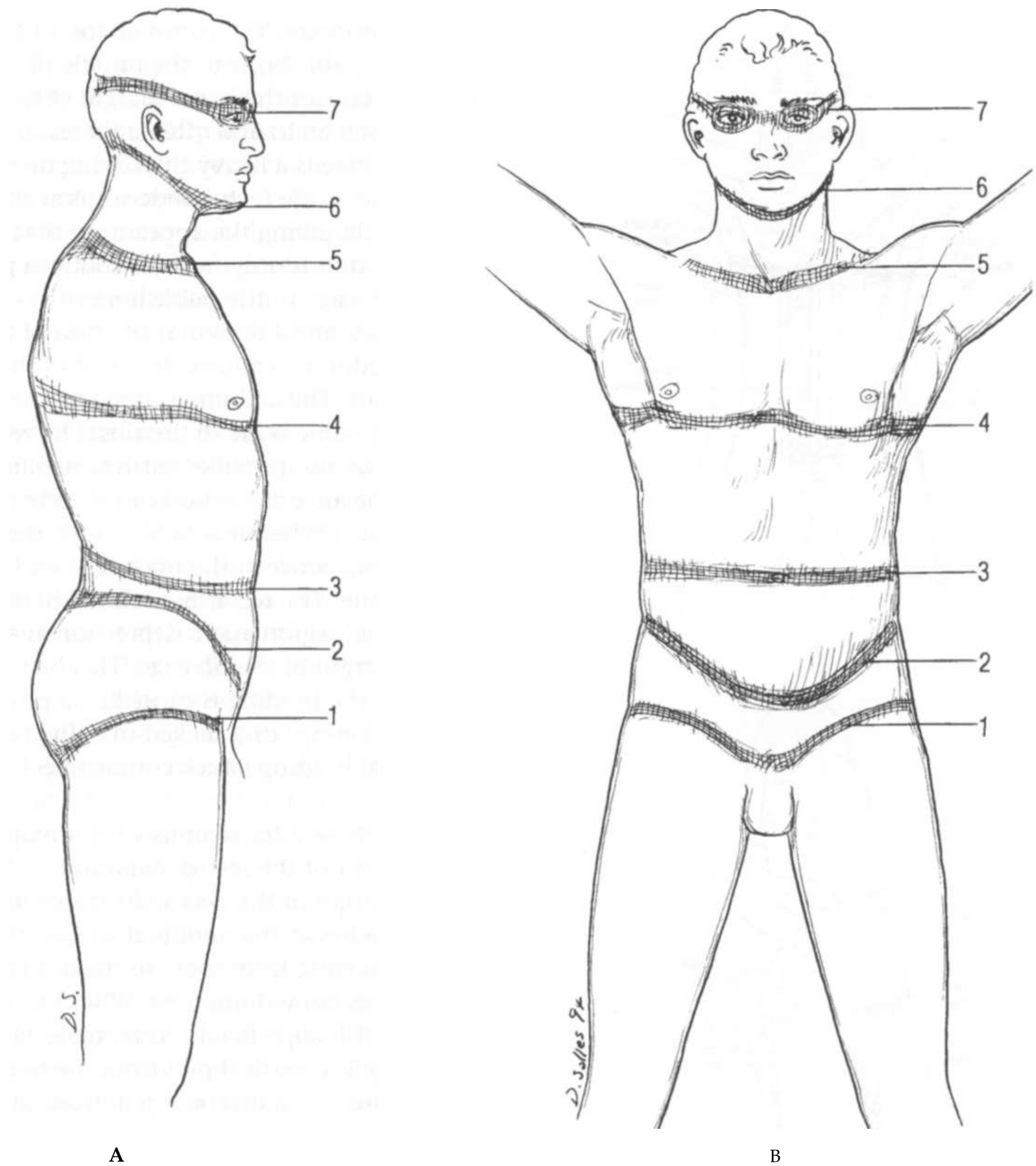
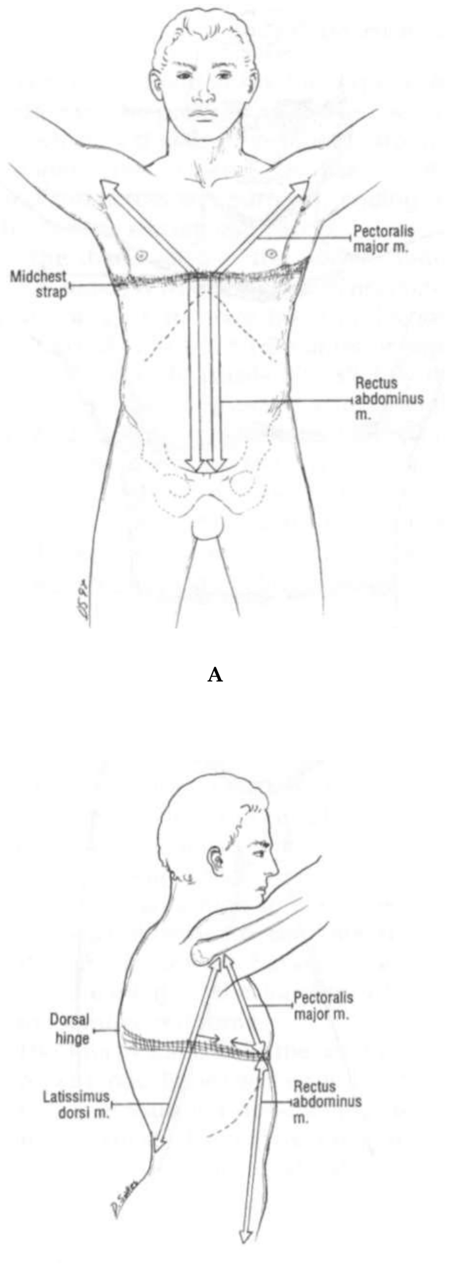


Figure 12-2
Body Straps: (A) side view; (B) front view

defines the connection from one side of the body to the other. We tend to ignore this right-to-left relationship across the sternum, yet it is an important one, reinforcing and often cementing side-to-side variations in movement. Because there is little muscle tissue over the sternum and ribs, it is easier to see where the connective tissue has become glued to the bony surface.

The band at its deepest level involves the underlying ribs and the intercostal muscles, restricting full expansion of this part of the rib cage in breathing. Superficially, the muscles that are visibly inhibited in their movement are the rectus abdominis and the



A

B

Figure 12-3
Mid-chest strap: (A) front view; (B) side view. The arrows denote the major lines of force of the muscles involved in the movement between pelvis and arms. Ideally, movement flows through the muscles in sequence. This flow is interrupted by the mid-chest strap. Its location is defined by the major lines of force of the muscles.

pectoralis major. The rectus abdominis spans from the pubic bone to the middle ribs of the chest. It crosses the lower margin of the rib cage (costal arch) and often adheres to it. In fact, there is a heavy thickening on the underside of the rectus abdominis at the costal arch, giving the appearance that the muscle extends only from the bottom part of the rib cage to the pubic bone.

By anatomical design, relaxation of the rectus abdominis allows the front of the rib cage to lift. The abdomen then lengthens from the pubic bone to the ribs. The rectus abdominis also provides vertical stability to counterbalance the action of the long muscles of the back. When it is held tightly, there is a shortening between the mid-chest and the pubic bone. The result is a folding in of the abdominal region and a depression at the lower margin of the rib cage. This is true whether the holding is caused by a postural holding (sit-ups or a sucked-in belly) or a structural holding (stuck connective tissue).

Immediately contiguous with the upper attachment of the rectus abdominis is the lower margin of the pectoralis major muscle. This attaches at the middle ribs, near the sternum, traveling from there to the upper part of the arm bone (humerus). What we have, then, at this superficial soft tissue level of the body, is a vertical pull from the mid-ribs downward and a diagonal pull from the mid-ribs upward. The overlap of these two pulls is at the sternum and includes the lower and middle part of the rib cage. Ideally, each of these two muscles is sheathed in its flexible envelope of connective tissue, allowing it to shift as the body moves from side to side, walks, etc. The muscle tissue of the rectus abdominis and the pectoralis major is separate, but their connective tissue forms a continuous, segmented web, allowing the movement of one muscle to be reflected into the other.

The superficial muscle and connective tissue pattern here may be imaged as a Y with a broad double base. Movement is transmitted vertically and diagonally across the chest. Where there is habitual restriction, the effect on movement is progressive. Where connective tissue is originally only lightly held down, bodily activity then tends to drag the margins of the two adjacent muscles closer together, causing the connective tissue to thicken.

As the strap continues around the side, going toward the back, it crosses the upper margin of the latissimus dorsi, a broad muscle arising from all the spines of the vertebrae from about T6 to the sacrum. Above, it narrows into a tendon that runs along the lateral outside margin of the shoulder blade (scapula). It ends in an attachment to the arm bone (humerus). The attachments of the pectoralis major and the latissimus dorsi on the arm are adjacent. They counterbalance each other and determine the openness of the armpit. The Y form on the front of the body (rectus abdominis and pectoralis major muscles) is thus balanced by a V form (latissimus dorsi muscle) on the back *(Fig. 12-4).*

The horizontal compression that we are calling a strap crosses from mid-sternum around to the side, overlapping the space where the pectoralis major and the latissimus dorsi muscles approach each other. These muscles should be free to slip vertically with respect to each other, leaving the arm full range of movement. When they are caught up in a restriction, the armpit is compressed. The strap here is very much like the bodice of a dress with an Empire waistline. Another image that comes to mind is the scaffolding of the bottom edge of a brassiere. The strap restricts lateral rib movement as well as movement to raise the arms.

From the lateral margin of the pectoralis major, the strap then crosses the lower tip of the scapula. It continues across the back of

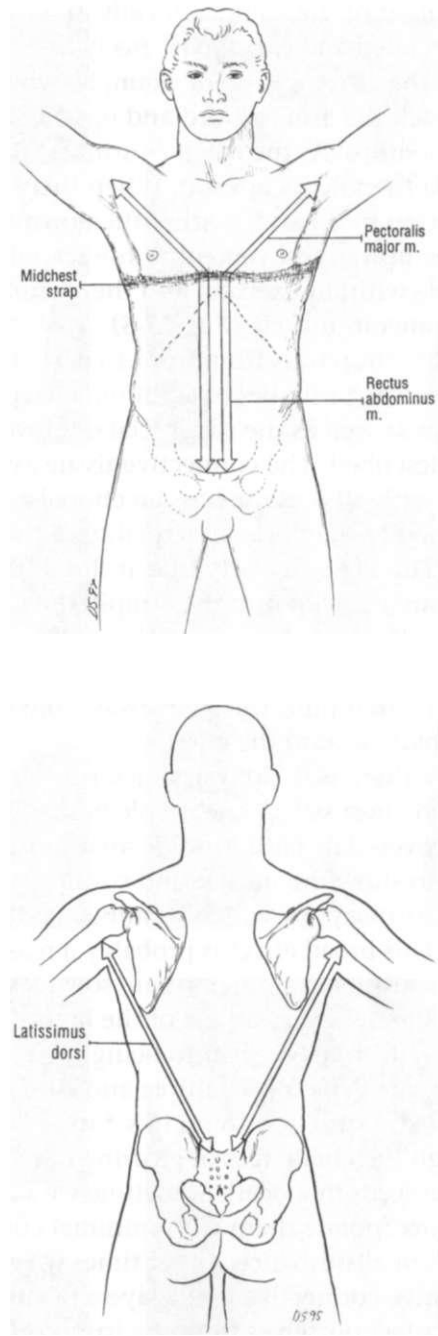


Figure 12-4
The "Y" of the front and the "V" of the back.

the ribs and the muscles of the back, and ends approximately at the dorsal hinge. When the strap is heavy and tight, it inhibits the movement of the scapula. Ideally, the scapula is suspended and can "float" freely over the ribs as the arm moves. For example, when you reach the arm forward and up, the scapula drops. As the reach continues, the scapula then floats upward. When there is a restriction by a band, neither the downward nor the upward movement of the scapula is possible without exertion and the recruitment of extraneous muscle ***(Fig. 12-5).***

As the strap runs from front to back, it crosses over a number of additional deeper muscles as well as the superficial ones we have described. The connective tissue associated with all of these has directional pulls that modify the horizontal quality of the strap. This is particularly true at the sides. There are pulls up into the armpit, down toward the lower lateral margin of the rib cage, and toward the pelvis. The result is a torquing that pulls the strap away from its main path around the chest.

This, then, is the physical description of the mid-chest strap—the nipple binder. We have covered its path in some anatomical detail to show the muscle and connective tissue pathways by which it influences the body. This broad effect is probably a reason that breathing dysfunctions are so widespread and influence every aspect of the body.

How do straps come into being? The reasons are generally multiple and cumulative. First, restrictions tend to set in as we go through the challenges of growing up. They are like seeds in a pearl. Sometime we successfully incorporate them with minimal connective tissue disturbance. Other times we grow successive connective tissue layers to cushion and protect ourselves from the irritation. The seed may be physical or emotional in origin. We have described several scenarios of physical origin.

As some girls first begin to develop breasts, they try to hide them. They cave in at the sternum and hunch their shoulders, creating stress at the dorsal hinge. Pudgy adolescent boys also can be uptight about nipples and breast tissue, and they hunch over for the same reason. An aberrant pattern takes hold in the body where there is the desire to hold down, control, hide. Control is really the most descriptive term here.

There are a limited number of ways to effect control in the body. While emotional rationales underlying any given structure vary, the physical holding falls into patterns. These patterns are what we see as straps. In mid-chest, the strap may be caused by an accident, by a desire to hide the breasts, by a desire not to breathe, by the need not to look different from everybody else, or by respiratory disease. All these different causes manifest in the body as a similar pattern.

The chest strap ties in with the familiar gesture of holding the arms to the side to guard the armpits. Armpits are sensitive and the protective gesture is similar in all individuals. As the strap becomes tighter and more firmly established, different parts of the body get drawn in. The pressure of hiding the armpits reinforces the tightness of the strap and inhibits the lateral (side) expansion of the whole top of the rib cage.

For example, in baby pictures at less than a year old, one child's shoulders were very narrow and high, obscuring the neck. The arms were closely pulled in to the sides of the body, protecting the armpits. As this child got to be about eight or nine, he went through a period of being a "sulky child." This gave impetus to the hunched-up physical pattern. As an adult, his chest seemed too narrow in proportion to the rest of his body. The effect of bodywork was dramatic: his chest got four coat sizes bigger. The bodywork didn't give him the new chest; it merely allowed him to use what was there.

A more emotionally based way of expressing what we mean is that the blueprint of the structural pattern starts in the baby, becomes

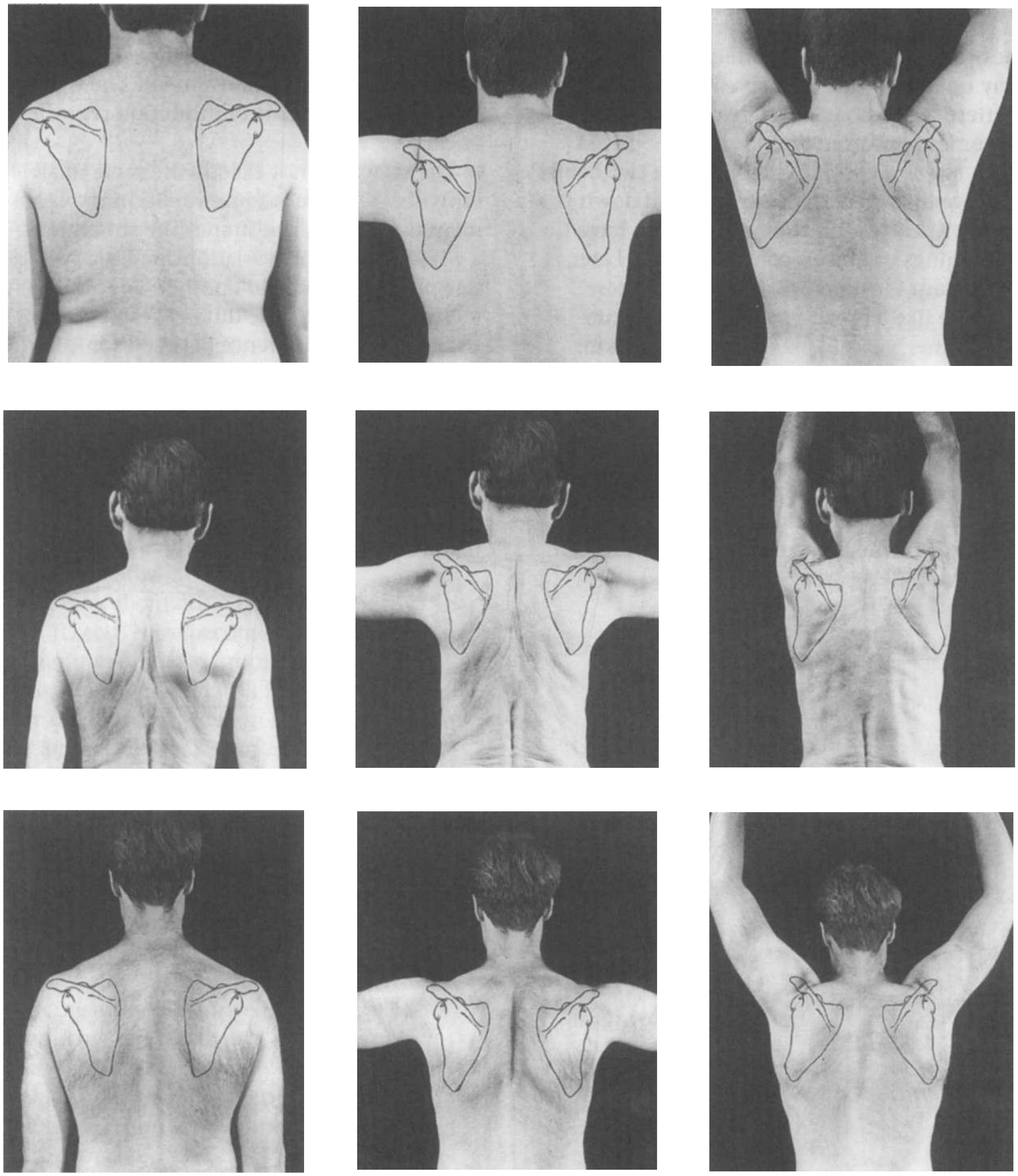


Figure 12-5
This array of shoulder movements provides comparison of three very different body types. The positions of the scapulae have been outlined. Notice the great differences in muscle recruitment at the elbow, neck, and along the spine.

established as the character type, and then is embedded as an attitude in the adult. It's not so much that the contractions start in any one place and then spread outward. The pattern as a whole is sketched in and then becomes reinforced and more pronounced with age and use. Judging from the two babies that we dissected, the pattern is laid down in utero. As early as in the newborn, we have the beginnings of fibrous concentrations. Later, if aberrant tensions are maintained, these become like a broad tendon. The structure sometimes looks like tendon in dissection; it certainly feels like tendon under the skin. But in "normal" anatomy no tendons are described in that location.

The restrictions inhibit our evolution to an "upright stance." Shoulders get raised as the chest sinks down and the head comes forward. Or the head may come forward first, and the others follow. Deciding which is first cause is difficult and usually not necessary. The body has certain places where it can most easily control its own movement. These create characteristic patterns of inhibition regardless of cause.

The straps are not exactly the same in all individuals. There is some variation in placement and shape. The strap is the structure as a whole. Individual variations pull it down in one place, tighten it in another. The attachments of the strap, the differences in emphasis, may be the difference between someone who is barrel-chested and someone who is very narrow front-to-back and wide side-to-side. We emphasize again that the strap is not a structure per se. It is a local change in the balance between fiber and matrix organization within the total connective tissue bed.

THIRTEEN

The Inguinal Band and the Structure and Function of the Vertebral Column in Relation to the Bands

Another visually obvious strap is what might be called the chastity belt or inguinal strap when seen from the front *(Fig. 13-1).* It is a connection between the top front bony protuberances of the hip bone (the ASIS or anterior superior spines of the ilia). This connection is like a half-moon shape, curving downward from these protuberances. The rectus abdominis muscle inserts on the pubic bone so that the strap crosses the lower part of this muscle. The strap broadens across the lower abdomen. In many people it includes not only fascial fibers but fat deposits as well. These can extend deep into the pelvis, filling the pelvic bowl.

This kind of fat is a type of connective tissue. Its cells have become engorged with an accumulation of fat droplets. There is very little intercellular matrix in this kind of tissue. The fibers are crowded in between the cells. Because of this lack of intercellular matrix, the fat tissue has become inflexible. It is therefore an effective inhibitor of energy and movement.

The strap across the groin is particularly apparent in people who perform constant repetitive exercises such as sit-ups and leg lifts. Gymnasts, for example, tend to have an almost horizontal line across the groin, forming a shelflike ridge in the lower abdomen. This can be felt as a tough margin halfway between the belly button and the pubic bone. The abdomen immediately above the ridge is noticeably more pliable, less rigid to the touch.

One of our frequent laments is, "No matter how much I diet, I never seem to get rid of my belly; it still sticks out." The bulge, however, has nothing to do with a need to diet.

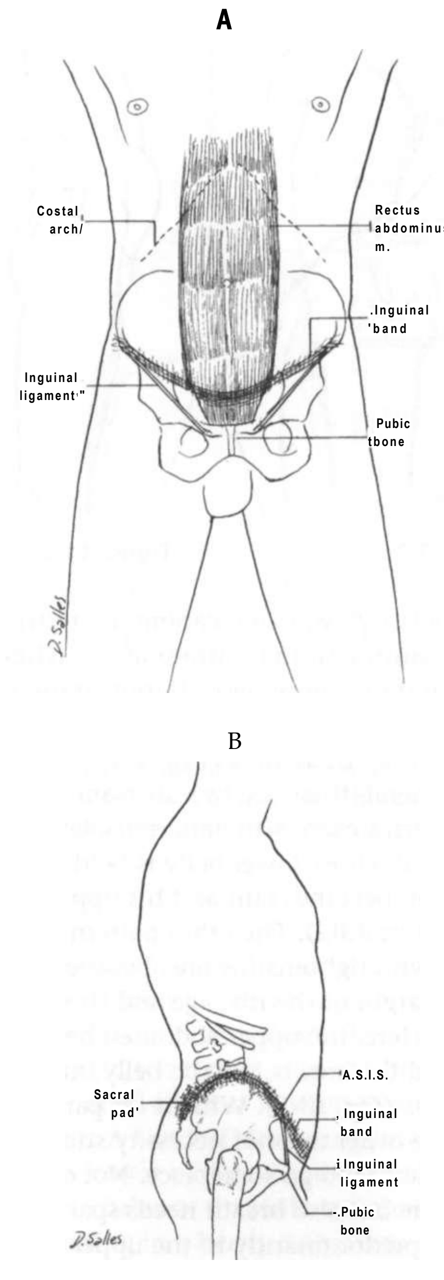


Figure 13-1
Inguinal band: Front and side views.

Figure 13-2

Figure 13-3

It is the body's way of escaping the restrictions resulting from tightness above (chest strap) and tightness below (groin strap). Or the tightness may bind at mid-belly; we talk about a strap there in Section 15.

In general, there are two aberrant abdominal patterns, each with variations. One is the individual whose lower belly is held in; his back then becomes taut and his upper belly bulges ***(Fig. 13-2).*** The other pattern is the person who tightens the area between the lower margin of the rib cage and the belly button. Here, the upper abdomen becomes tight and the area below the belly button protrudes ***(Fig. 13-3).*** Whichever part is being held, the other must of necessity stick out; the tissue has to go someplace. Not only the soft tissue but also breath needs space. People breathe predominantly in the upper or lower abdomen. In either case, the holding interferes with the free flow of breath, energy, and movement.

The inguinal strap continues around the sides of the hips. It seems to cross just below the upper edge of the hip bone (crest of the ilium). This creates a tension across the bone and pulls the connective tissue into folds. These folds come into being much the way pulling on a corner of a sheet creates deep pleats in the fabric. Similarly, pulls across the back of the upper pelvis and the sacrum give rise to tendon-like structures across the lower back. These can feel literally like small ropes or cables under the skin. In some individuals, it almost feels as though these ropes have knots in them. They form a stressed connection across the upper margin of the sacrum and the lower lumbar vertebrae, tying left and right sides together.

Most "lower back pain" appears to come from this region. These ropes tying together the three bones (sacrum and two ilia), inhibit sacroiliac movement. This immobility across the sacrum is the major contributor to lower back syndrome. Children typically show a lot of movement across the sacrum. This movement often disappears in later life, probably in the teens. We all seem to want/need to control pelvic movement.

The inguinal band blends into the fascial and/or fatty pad normally present on the sacrum. When this is too thick, it adds to the immobility of the area. The band thereby is continued down to the tailbone (coccyx). In design, it resembles a jockstrap or dancer's belt. The bottom part extends down between the legs to the V-shaped bony base of the pelvis. Here it blends with the fat and fibrous tissue that is the normal filling of the space between the legs (between the coccyx, pelvic rami, and pubic bone). When the V of the rami is compressed and too narrow, particularly in men, this tissue can feel like cement and it often becomes a filler through the whole basin of the pelvis. Thus straps are not only surface phenomena but traverse the body space.

The front of this band is easy to see and feel and is much the same in all people, although it varies in degree of tension. In back, in addition to the surface ropes that run parallel across the upper margin of the pelvis, there is often a deeper set of tensions near the top and side of the sacrum. This is associated with the fascia of the gluteal muscles and runs from the surface to deep in the pelvis, down to the bone. Many men are too narrow at the base of the pelvis, between the legs. This results in an abdomen that is proportionally too wide in front. The hip bone looks as though it wings out. This again adds to a wide abdominal contour.

In men, the connection across the front of the groin seems like a band trying to hold the lower abdomen together. In women, the same kind of narrowness is more common in back, across the sacrum. In both cases, the tension on the outside of the pelvis produces a corresponding tension on the inside. There is a complete set of muscles on the inside of the pelvis as well as on the outside. The connective tissue of the outside muscles (surface) relates the movement of the lower back region to the outside (lateral side) of the leg *(Fig. 13-4).*

The connective tissue of the psoas extends from the inside lower back to the inside (medial side) of the thigh at the lesser trochanter *(Fig. 13-5).* The two fascial planes (surface and deep) balance each other. Tightness in one will be reflected in the other with every movement of the leg or pelvis.

In walking, the most prominently involved muscle structure from inside the pelvis is the iliopsoas and its associated fascia. We will discuss the psoas muscle in Section 19. The iliacus, the other part of the iliopsoas complex, lines the inside of the bowl of the pelvis. It diagonally crosses the pubic bone and attaches on the inner part of the leg at the lesser trochanter. When the pelvis is bound tightly in back, the anterior superior spines

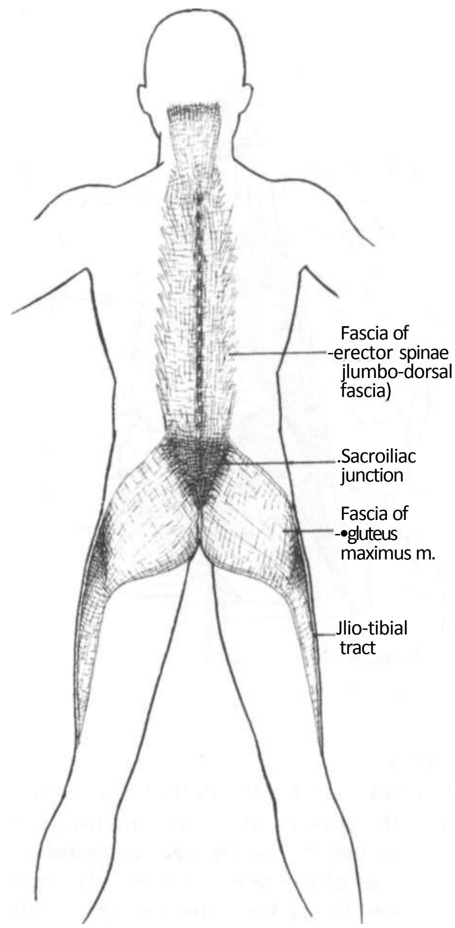


Figure 13-4
The connective tissue of the surface muscles relates the movement of the lower back region to the outside (lateral side) of the leg.

of the ilium wing out in front. The iliacus then tightens and is too short to function with ease. The brim of the pelvis is pulled forward and down toward the pubic bone. When the iliacus is very short, the inside of the leg is held too tightly into the hip socket. The result of all this is a tension around the pubic bone. A band of strain (inguinal strap) across the lowest part of the abdomen attempts to balance that internal shortness, often resulting in a heavy fatty connective tissue band on top of the pubic bone.

In men, both sexual function and feelings about castration are connected to this band.

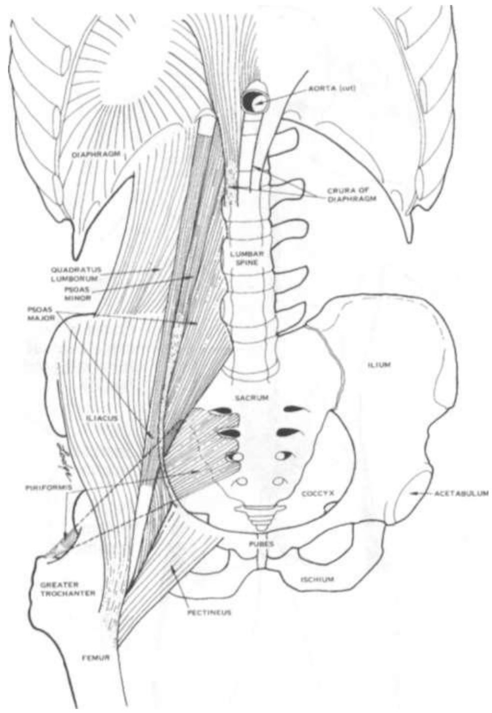


Figure 13-5
This drawing from Dr. Ida Rolf's book on Rolfing illustrates the psoas and iliacus muscles on the inside of the pelvis. The connective tissue of these inside muscles of the pelvis connects the inner abdomen and inside lower back to the inside (medial side) of the thigh.

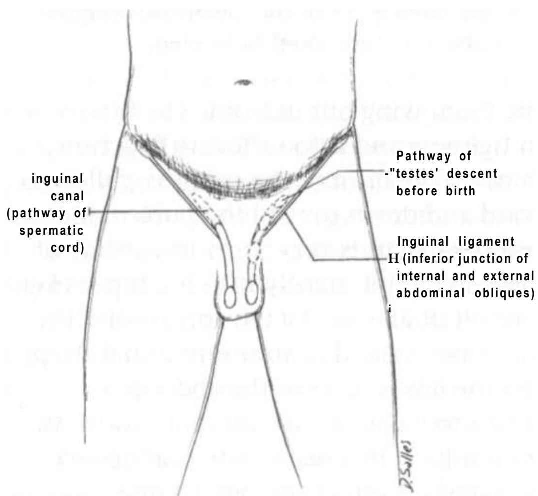


Figure 13-6
Inguinal band and descent of testes.

Restriction in the groin and pubic region often serves to block or dampen sexual enjoyment. It's almost as though the penis is hung through the band, so that the tightness of the band can block the orgasmic wave to the rest of the body. This limits sexual enjoyment to the penis. Another element in sexual blocking is men's castration worries. These seem to be centered not around the scrotum, but at a more lateral region of the groin where, before birth, the testes leave the protection of the body. They descend between the thin layers of the lower abdominal wall down into the scrotum by way of the inguinal canal ***(Fig. 13-6).***

The inguinal canal is the target of a variety of problems, particularly in men. Inguinal hernias seem to be the result of excessive strain and postural holding on an area that is vulnerable and unprotected. We have found that lessening the tightness of the groin band reduces the severity of the hernia or eliminates it. The groin area is tight in most men, who often have a "don't touch" signal there such as ticklishness.

For both men and women, the band often shows up in the breathing pattern; abdominal movement from the breath goes as far down as the banding, not all the way down to the pubic bone. In women, the strap is more commonly focused deeper in the lower abdomen, shelving underneath the ovaries and functionally separating the ovaries from the genitals. This is a large factor in premenstrual syndrome and the reason PMS so often does not yield to medication. The banding tends to be deep and shelflike, so that accommodation of the necessary changes in posture caused by pregnancy is inhibited. In pregnancy, the weight of the baby rests down into this shelf, causing it to become thicker and less resilient. After birth, the thickened band remains.

The pelvic strap widens in back, often rising as high as the twelfth rib, where it meshes with the fascia of the muscles along the spine.

As we have said, the band at mid-chest blends with the fascia of the dorsal hinge in the region of the sixth dorsal vertebra. Clearly, therefore, the structural inhibition created by the bands influences spinal integration and movement. In turn, restriction of movement at the junctions of the vertebral column increases the tightness of the bands. Interference in spinal function leads to characteristic changes in posture and physical behavior. We therefore digress to describe some aspects of the structure and function of the vertebral column in relationship to the bands.

The muscles and fascia that run longitudinally from the neck to the sacrum are a complex interweaving of layers. They stabilize the variety of movements of the different bony vertebrae that make up the spinal column. Although the vertebrae are similar in shape, they are different in details of design and size. These differences imply differences in range and direction of movement. In general, the bands relate to junctions of the spinal column, places where the vertebrae change shape. These junctions are between the head and neck (occipito-cervical), between the neck and chest (cervico-dorsal), between chest and lower back (lumbo-dorsal), between lower back and sacrum (lumbo-sacral), and between the sacrum and tailbone (sacro-coccygeal). The dorsal hinge is Ida Rolf's addition to this list *(Fig. 13-7).*

The change in vertebral shape at the dorsal hinge is more subtle; the change in movement pattern is most visible in a living, moving body. The reason for this apparently is that the change in function and morphology here entails the soft tissue and outlying bones as well as the vertebrae themselves. This is somewhat true everywhere along the spine, of course, but it is more important in the upper chest. The additional stabilizing influence from the shoulder blade and its soft tissue connections to these vertebrae modifies their movement.

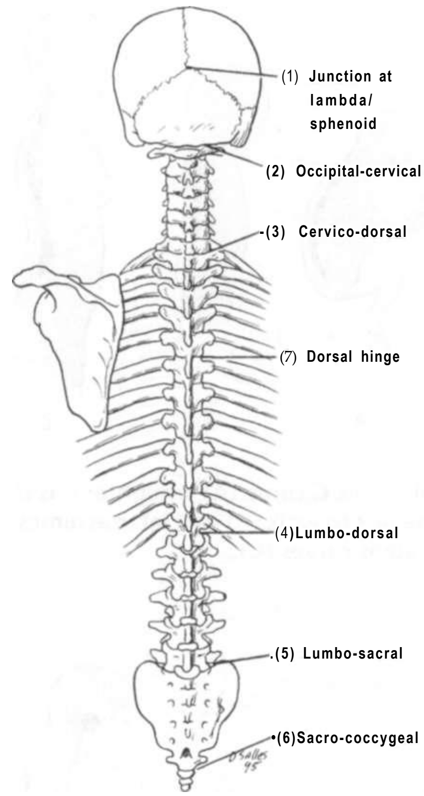


Figure 13-7
Junctions of the spine.

On the inside of the body, just in front of the spine, lies the autonomic nervous system (ANS). This runs longitudinally from the base of the spine up into the head. Along its length there are a number of spinal plexi. These are interruptions in the flow of infomation along the system. They serve much the same function as a busy telephone exchange; they are places where neural messages can get transmitted in diverse directions. Generally speaking, the ANS nerve plexi are located near the spinal junctions that we listed above. It is interesting to note that these places of maximum movement of the spine are associated with centers of most complex ANS activity. When there is ease of movement at these junctions there can be stimulation of the nervous impulses that control metabolic activity.

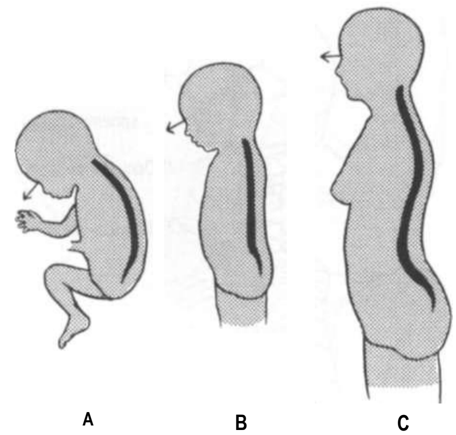
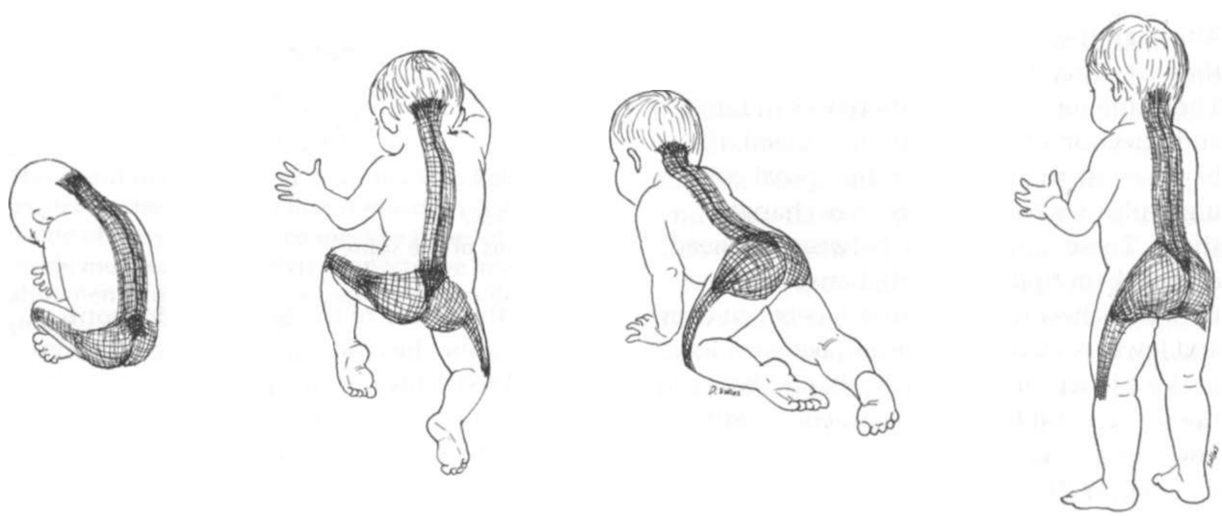


Figure 13-8
The embryonic C curve (A) straightens as the infant begins to walk (B) and later assumes the normal adult curves (C).

As the embryo is enfolded in the womb, its back describes a C curve ***(Fig. 13-8).*** As we have said, this is not a smooth curve; it is a series of bends in the back. These bends are located at what will become the spinal junctures. The embryonic C curve opens after birth as the child explores and learns to stretch and lengthen. Ultimately, there is a change in the direction of some of the angles, creating the snake-like form of an adult upright spinal column.

Bonnie Bainbridge Cohen's Developmental Movement Sequences* graphically

*See Bonnie Bainbridge Cohen, *Sensing, Feeling, and Action: The Experiential Anatomy of Body-Mind Centering* (Northampton, Massachusetts: Contact Editions, 1993).



A **B** **C** **D**

Figure 13-9
Developmental movement sequences: (A) intrauterine folding; (B) contralateral creeping; (C) crawling; (D) standing.

demonstrate how these flexures interact with movement. As she describes the sequence, in the first days after birth the newborn extends its head. Soon it raises the head, then pushes off with its hands. Full mobility increases with homolateral movements—fishlike swinging from side to side. Then contralateral creeping and rocking prepare the body for crawling *(Fig. 13-9).*

These movements correspond to the activation of both the spinal flexures and the associated ANS plexi: (1) junction at the sphenoid (see Section 14 on the eye band, below); (2) junction between head and neck; (3) junction between neck and chest; (4) junction between chest and lower back; (5) junction between lower back and sacrum; (6) junction between sacrum and coccyx; (7) junction at dorsal hinge *(Fig. 13-10).* Cohen has noted that when a part of this sequence is omitted in childhood, there can be dysfunction, and that this dysfunction is correctable even in the adult as the missing movement pattern is practiced. There is often resistance to activating some or all of these spinal junctions. The reasons relate to many life traumas. One of the most jolting can come very early in life. Dangling a newborn by its feet at birth shocks the safety of the curve with almost a snapping movement. The resulting position as the child hangs head back and spine locked in a backward curve causes an acute wrenching and ripping of fragile fascial connections. This is very similar in effect to a whiplash injury in an auto accident.

Most people unconsciously try to retain some part of their fetal curve. The body straps are a way of fostering this because

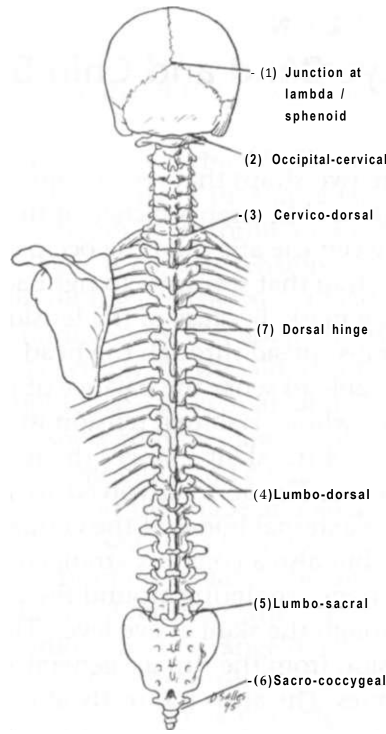


Figure 13-10
Spinal junctions.

they compress the body at spinal junctions. The straps create a system of transverse reinforcing structures where we don't want to (or can't) trust the undulations of an upright spine. Their tendency is to pull us forward and down in front. Kinesthetically, this is sensed as resistance to the feeling of openness that comes with being upright. It isn't that the spine (and the body) contracts; it's that it refused to open up. Emotionally, we feel that safety lies in the curled-in-on-oneself position. It's really a remembered safety. True adult stability and safety lie in being upright, flexible, and resilient.

FOURTEEN
The Eye Band and Chin Band

There are two straps that restrict movement of the head—a chin strap attached at the junction between the atlas and the occiput and another strap that seems to go right across the eyes like a mask. Because of the tension that these straps spread through the head, most of us aren't able to sense the balance of the cranium as a whole. Habitual tension in the surface tissue of the skull changes the relations of the bones. The bones involved are not only the larger external bones of the cranial vault and jaw, but also a complex arrangement of delicate bones centering around the eyes and back through the skull at eye level. The strap-like tension from the surface generalizes to these bones. The areas indirectly affected include the brain stem, the limbic system, and the pituitary and pineal glands.

The eye strap lies roughly across the eyes and above the ears ***(Fig. 14-1).*** In the back, it is at about the main junction of bones of the skull. Starting at the front midline, this band crosses the muscles on the bridge of the nose, the circular muscles ringing the eye sockets, the upper muscles that let you wiggle your ears, and the temporalis muscle and its fascia attaching to the jaw.

The eye socket is composed of a fusion of a number of bones ***(Fig. 14-2).*** The upper portion is the frontal bone, which continues on as the major bone of the forehead. Medially, there are lacrimal and ethmoid bones, which also form the upper medial part of the nasal cavity. The lower part of the orbit is a continuation of the maxilla (upper jaw). Laterally there is the zygomatic bone, which continues as a bony arch toward the ear. Posteriorly (the back of the orbit) there is the sphenoid bone, which also forms part of a shelf below the brain. These bones are tied together by sutures that anatomists consider to be

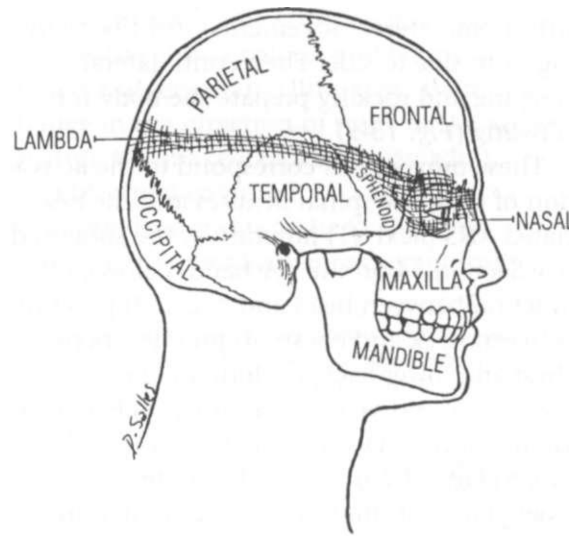


Figure 14-1
Eye strap.

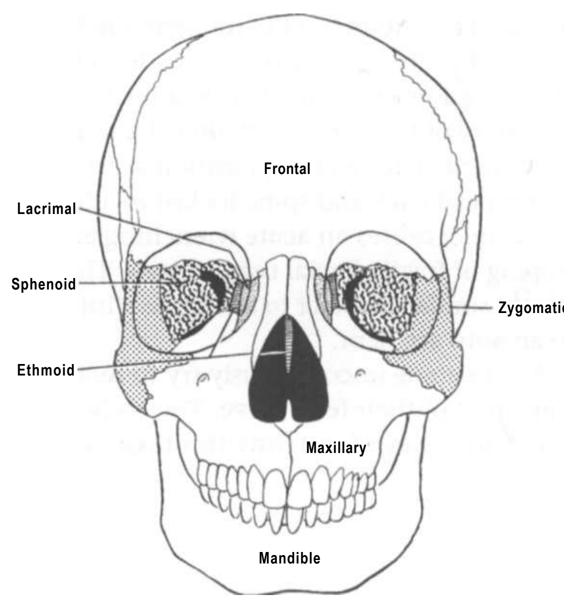


Figure 14-2
Bones of the eye socket.

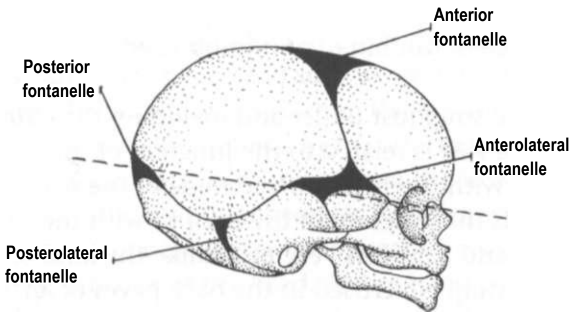


Figure 14-3
Fontanelles are locations of non-fusion between bones in the fetal and infant skull. The dotted line embryologically is the site of the first flexure of the body.

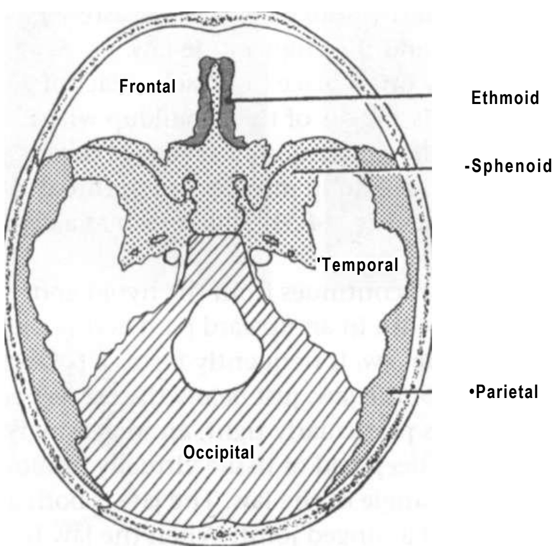


Figure 14-4
Notice the juncture between the sphenoid and occipital bones at the base of the skull. This interface is the focus of most cranial manipulation.

immovable joints.

William Sutherland,* the originator of cranial osteopathy, realized that slight interosseous movements, which he termed the breathing of the skull, are necessary for the head to function. Although these are very tiny increments of movement, they nevertheless significantly affect facial expressiveness as well as the free use of the senses—sight, hearing, smell, taste.

Tension across the orbit of the eye can result in a narrowing of the entire facial region. The bones of the orbit are squeezed together. There is chronic tension in the eye socket and on the eyeball itself. Good vision relies on minute muscular adaptations for near and far vision. As we said, connective tissue is tightened—loses adaptability—when its associated bones are compressed. Prolonged immobility and compression in the socket distort the shape and adaptability of the eyeball itself. This may account for a number of common visual problems. When, through habitual tensions, the eyes are fixed in one attitude, the free range of emotional expression is also diminished.

This topmost band relates to the suture called lambda (at the posterior fontanelle). This is not as obviously a spinal flexure as are the vertebral flexures. In embryological terms, it is the fusion of the apical (topmost) bones. In fact, embryologically this is the site of the first flexure of the body *(Fig. 14-3).*

We have talked about the sphenoid bone in relationship to the eye socket. The sphenoid can also be considered the hub of the bony skull when seen from above *(Fig. 14-4).* It is shaped like a butterfly whose wings reach to the surface of the head in the flat area just lateral to the eyes. Because of its location, the sphenoid can get locked in place as a result of tensions from the surface. When the eye band tightens, the sphenoid can't move. Conversely, what happens on the inside of the head is reflected on the surface.

On the cover of *The Protean Body* by Don Johnson/ there is a drawing of the sphenoid floating in the air. Seen like this, in isolation from the rest of the bones of the cranium, it

*See William G. Sutherland, *The Cranial Bowl* (Meridian, Idaho: The Cranial Academy, 1948).

tSee Don Johnson, *The Protean Body* (New York: Harper & Row, 1977).

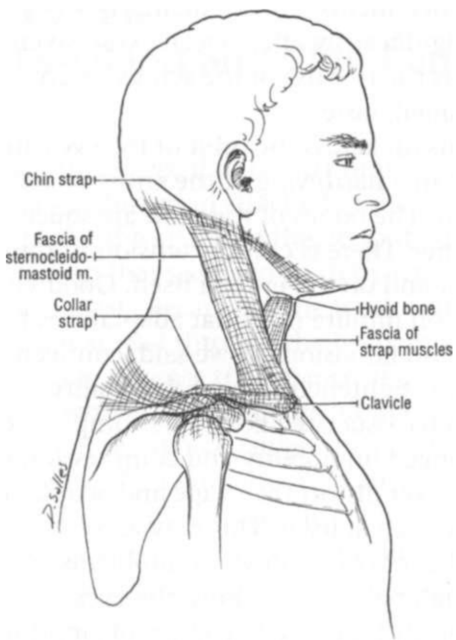


Figure 14-5
Chin and collar straps.

is easily mistaken for the bony pelvis. This similarity is more than visual. In fluid body movement, sphenoid and pelvis move in concert and reciprocally If one doesn't move, the other is inhibited in its movement, as has been demonstrated in Sutherland's cranial osteopathic work. A further relationship between sphenoid and the bony pelvis lies in the fact that they both house important endocrine glands. The pituitary gland lies in an indentation at the center of the sphenoid. The gonads develop within the protection of the bony pelvis.

Cranial osteopaths have made the observation that the sphenoid rocks. There is some controversy about whether this movement is the result of an inherent body rhythm or a response to the rhythm of the breathing. In either case, the movement is observable and palpable. We have seen this rocking reflected between pelvis and sphenoid. When one of the endpoints of this flow can no longer respond freely, the other endpoint is also restricted, inhibited, or immobilized.

The strap just under and including the chin *(Fig. 14-5)* is related to the juncture of the head with the first two vertebrae of the neck. This is the juncture of the occiput with the atlas and axis. It is very much like the kind of chin strap advertised in the back pages of an old-time fashion magazine, designed to lift sagging or double chins. It surrounds and binds down a floating bone on the front of the neck called the hyoid. This U-shaped bone defines the angle between the chin and the throat. The hyoid anchors many of the so-called strap muscles of the throat. It is the keystone of the bridge between breastbone (sternum) and the angle of the jaw.

Like any other place of muscle attachment, the hyoid is a focus of tissue buildup when there is habitual tension. It is tugged downward when the strap muscles of the throat are overly tense ***(Fig. 14-5).*** This is seen as a double chin.

The band continues from the hyoid and under the chin in an upward path across the angle of the jaw. It frequently forms a pad on the angle of the jaw, just below the ear. When the band is particularly tight, an increasingly dense and deep pad of tissue virtually immobilizes the angle of the jaw. The jaw is both a sliding and a hinged joint. When the jaw is strapped back, the sliding motion is limited and may disappear. As we see it, this is a major factor underlying temporo-mandibular joint (TMJ) problems.

The continuation of the band thickens around the mastoid process behind and below the ear and goes on to restrict the junction between the occiput, atlas, and axis. When this happens, nodding becomes an effort and the head's gliding response to walking is bound down.

The actual junction of the skull with the top two vertebrae is covered by a heavy fascial pad about an inch thick. This is one example where a natural padding in the body can serve as part of a surface band such as we are describing. The difficulty arises when the tension is excessive and becomes a tight surface strap.

Extreme tension at the back of the head pushes the skull bones too far forward over the neck bones, giving the appearance of a very flat back of the head. As the band contracts and distorts the position of the hyoid, this generalizes tension into the back of the tongue. We don't think of the tongue being tense, but it can be. Moreover, the condition of the esophagus and trachea is under the influence of these tensions. Voice students, for example, learn to release these tensions and control these tissues with minute awareness.

Visualization of the upper body bands on photographs is shown in Figure 14-6.

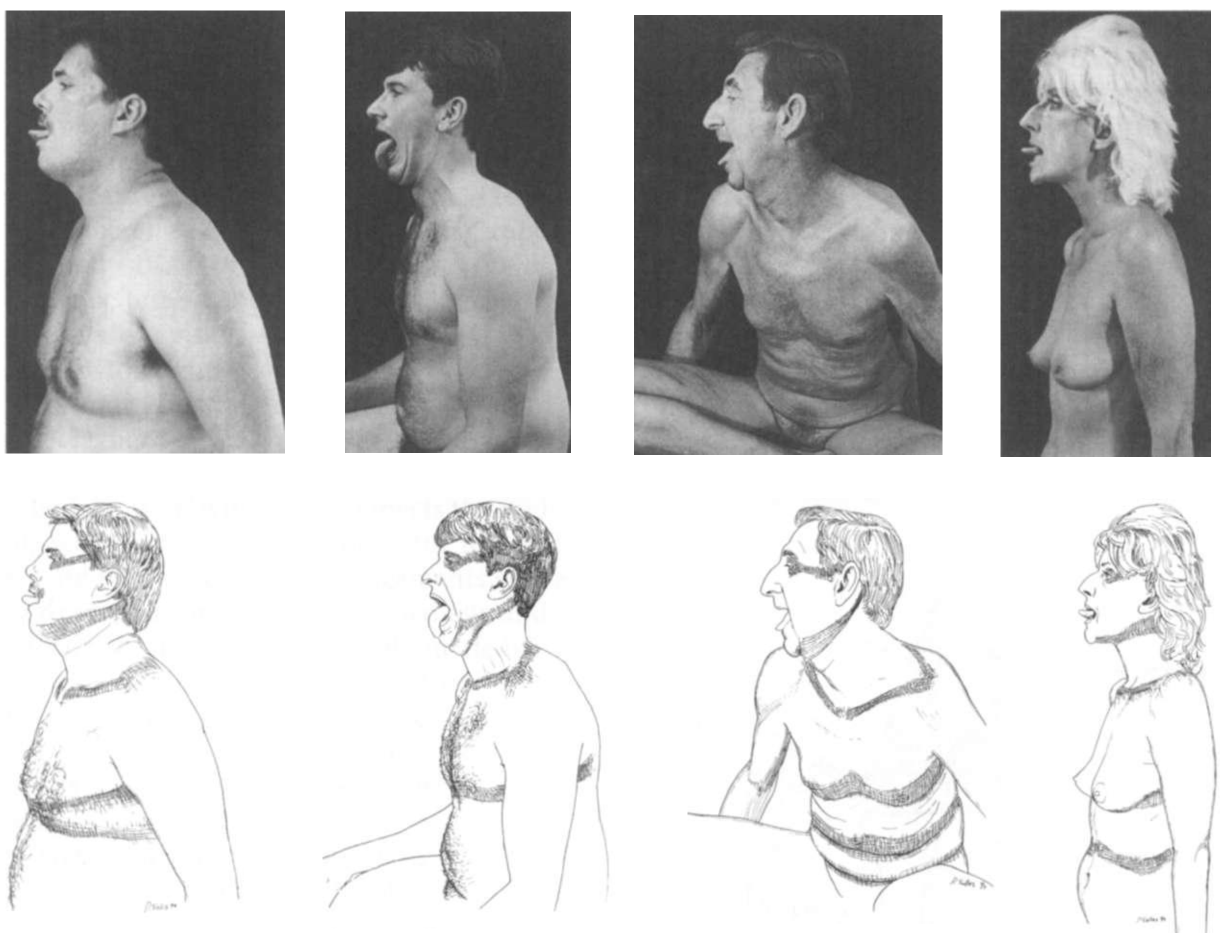


Figure 14-6
Upper body bands.

FIFTEEN

The Collar Band, Umbilical Band, and Groin Band

Like the chin strap, the next strap—the collar strap *(Fig. 15-1)*—is of great importance to singers, whether opera or shower singers. It involves primarily the base of the throat, the upper tip of the lungs, and the upper margin of the shoulders. When this strap is very tight, its most striking feature is a tightness underneath the Adam's apple where the two clavicles (collarbones) meet the sternum (breastbone). The most common result is compression around the base of the neck. The collarbones are tightly glued down to the upper ribs in front and tightly held to the upper margins of the shoulder blades (scapulae) in the back. Deep hollows at the base of the neck, just behind the collarbones, are evidence of tension when this strap has become too tight.

In front, the strap seems to enclose the whole length of the collarbone as well as the two uppermost ribs. It includes a small muscle called the subclavius. This connects the middle section of each collarbone to the first and second ribs and continues as ligaments to the sternum and coracoid process, medially and laterally, respectively. This small muscle is active in respiration when the collarbone moves in relation to the ribs. When the fascial covering of the muscle is thickened, the subclavius is immobilized between the two bones.

The collar strap continues along the clavicle to the tip of the shoulder blade (acromion). This projects like a bony shelf over the topmost part of the arm bone (humerus). When there is a heavy pad on top of the acromion, any movement is inhibited between clavicle and scapula and acts as a brake on the lateral (sideways) movement of the arm. The clavicle articulates with the acromion just in front of the shoulder joint. This is traditionally designated as a slightly movable joint, which can be a misleading concept. For example, in a wheel with ball bearings, the ball bearings move only slightly. But if one is stuck, the larger movement of the wheel stops or eccentrically grinds down its components.

The strap continues toward the back along the inner and outer margin of the scapula. It ends by spreading out over the area of the dowager's hump—from the upper medial tip of the scapula to the cervicothoracic junction.

This strap at the base of the throat, like the other straps, can be compared to a piece of cloth in which part of the weaving is very tight and part of it is very loose. The tightest area binds the clavicle and the upper part of the scapula. The looser extensions broaden its influence out into the upper part of the arm, pulling the arm in closer to the body and

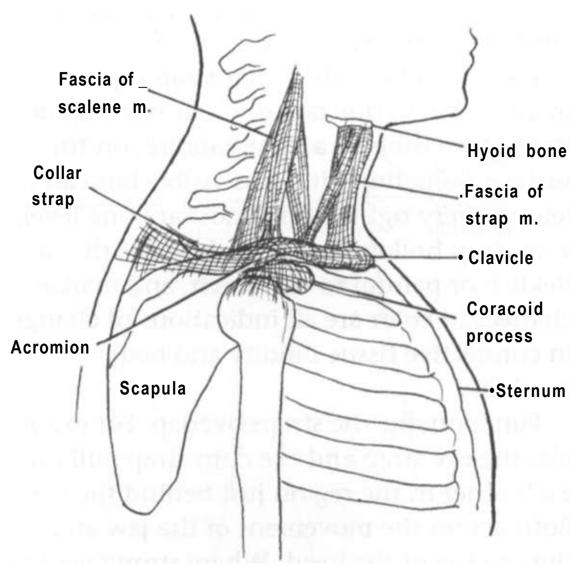


Figure 15-1
The collar strap.

rotating it slightly out of its socket. Other fibers extend into the armpit, closing the armpit and compressing the upper ribs. These concentrations of fibers we call straps not only circle the body on its surface but have a third dimension going deep inside, crossing the body like a shelf. In the collar strap, the shelf can be seen on the surface of the body. It crosses over the often-hollow spot in the base of the neck containing the scalene muscles ***(Fig. 15-1).*** The underside of the scalenes can and often does have a fascial connection to the upper tip of the lungs. Very few of us are aware that lungs extend so high up in the body, and a miniscule number of us make use of this upper tip of our respiratory capacity.

Two characteristic movement patterns reinforce the tightness of this strap—compressing the armpits and hunching the shoulders. Armpit compression is a kind of guarding, protecting the body because of ticklishness, habitual anxiety, protecting the breasts, etc. Shoulders pulled up can also be a response to perpetual anxiety, or it can be carrying the weight of the world on your shoulders. Mindset very quickly becomes bodyset. Both result in lack of mobility in the upper ribs and a kind of breathless feeling.

Like the others, the collar strap is present in all bodies to one degree or another. Sometimes it is visible as a light banding on the surface. Sometimes it is less visible but can be felt as a very tight band almost at bone level. Very deep hollows in the body, areas that are ticklish or painful to the touch, and marked changes in color are all indications of change in connective tissue fluidity and body flexibility.

Functionally, the straps overlap. For example, the eye strap and the chin strap pull on each other in the region just behind the ear. Both act on the movement of the jaw and the tipping of the head. Where strong vertical muscular and fascial pulls cross the bands, the strap then becomes locally denser both in its horizontal direction and in the vertical cross-bandings. When both pulls are unusually strong, the whole area becomes a thickened mass of tissue.

This kind of interaction also occurs between the chin strap and the collar strap, and it strongly influences the front of the throat. Four muscles (commonly termed the strap muscles) attach the hyoid bone to the upper tip of the breastbone. The larger sternocleidomastoid overlies these and provides a direct vertical connection between the two straps. Chronic tension in the fascia surrounding these muscles brings the front part of the two straps closer together, as can be seen in people who "lead with their chins."

Tension in this area affects speech as well as more complex vocalizations such as singing or playing a wind instrument. Any stressful situation can serve to tighten the throat area. When angry, one's voice may rise or words may not come out. In grief we get "all choked up." This is at least part of the mechanism that underlies fear of public speaking.

The chest strap (see Section 12) interacts with the collar strap via the connective tissue of the pectoralis major; this can cause a vertical compression on the upper chest. Reduced range of motion in the shoulder (collar strap) correlates with lack of movement in the upper ribs and shortness of breath. Tightness from both of these straps into the armpit inhibits freedom of movement of the arm at the shoulder joint from above and below.

The strap associated with the umbilicus ***(Fig. 15-2)*** in the front and the lumbo-dorsal hinge in the back tends to make the body look as though it were divided into an upper and a lower half. It is variable in its position relative to the umbilicus. It can run just under the small cartilage at the bottom of the sternum (the xiphoid process), a few inches above the umbilicus. It may run directly across the umbilicus, forming a deep indentation extending out to either side. Or it may extend across the abdomen an inch or so below the umbilicus *(Fig. 15-3).*

The band continues toward the sides, in most cases a little below the arch of the ribs. It seems to run both inside and outside the ribs, generally pulling the free ends of those ribs deep inside the body. In doing so, it may compress the action of the lateral part of the diaphragm. The strap continues to the back by way of the twelfth rib into the lumbo-dorsal junction, often immobilizing the free tips of the tenth and eleventh ribs. There is some semblance of this strap in everyone. At the sides, it is a component of the very common tension centered on the free margins of the lower ribs. The tip of the eleventh rib is pulled deep into the body in most people. Ideally, the eleventh rib lies just below a thin sheath of muscle and skin and establishes the width of the lower chest in the back. How deeply it is pulled into the body seems to influence the position of the strap (and vice versa). It is possible for the twelfth rib to be deflected down almost to the rim of the pelvis. Similarly, the eleventh rib can be pulled down toward the pad on the crest of the hip bone.

The free ribs—tenth, eleventh, and twelfth—are attached to the diaphragm and establish its width and range of movement. The umbilical strap is thus closely associated with the diaphragm on the side. The result of tightness in the strap is a diaphragm that is functionally and structurally too narrow and consequently overworked. Breathing capacity is more labored and the diaphragm begins to act like a retaining shelf across the body. An extreme version of this is known as a pigeon breast.

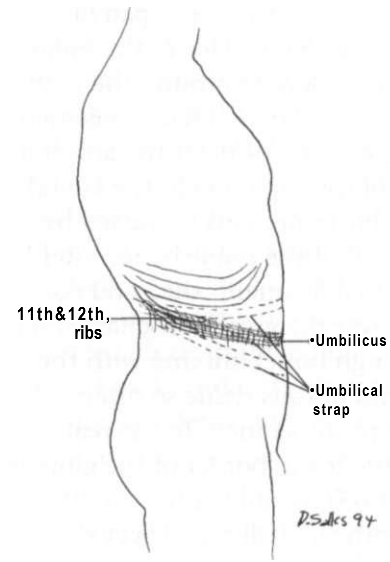


Figure 15-2
Note that the area of the eleventh and twelfth ribs is the lumbo-dorsal junction.

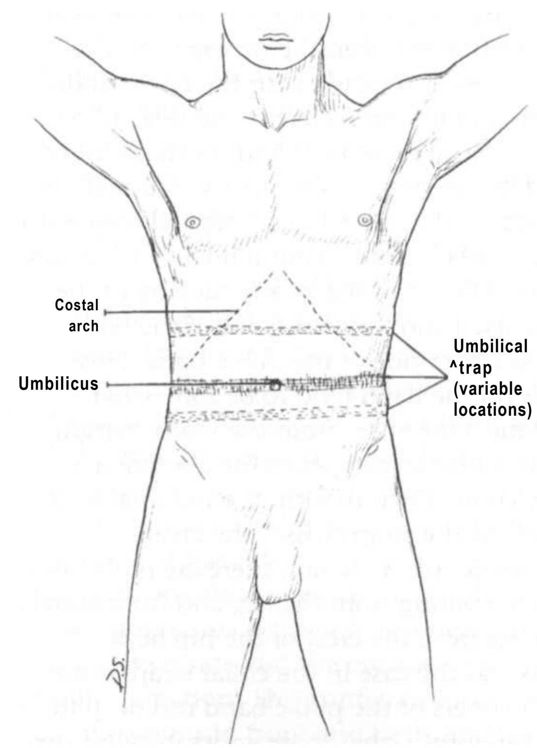


Figure 15-3
The location of the umbilical strap is variable

The pubic or groin strap is the lowest strap in the abdomen *(Fig. 15-4).* It may be seen on the front of the body in the dense pad of connective tissue on the surface of the pubic bone. It continues sideways around the body, crossing the groin. A diagonal heavy ligament (the inguinal ligament) connects the anterior superior spines of the hip bone to the lateral points of the pubic bone. This is crossed by the horizontal pull of the pubic band. After it crosses the inguinal ligament, the band continues laterally over the greater trochanter (at the top of the thigh bone), mixing with the buildup of fat and fibrous tissue so often found over that protuberance. To the rear, it runs deep to the lower border of the gluteus maximus ***(Fig. 15-5)***, ending at the junction of the sacrum with the tailbone (coccyx). Posteriorly, it contributes to (and sometimes forms) the gluteal fold. It blends into the heavy pad found on the ischial tuberosities (sitting bones).

Strong cross-pulls are associated with this band. In the center front, there is a vertical connection between the rib cage and the pubic crest associated with the rectus abdominis and its connective tissue ***(Fig. 15-6)***. This vertical retaining band for the front of the body is very commonly hypertoned (overstrong). This relates to our cultural preference for a flat belly and to our tendency to overexercise. The act of habitually sucking in the belly itself shortens the front of the body.

On either side of the pubic bone, cross-pulls on the band tend to be somewhat oblique. One arises from the lower margin of the oblique muscles of the abdomen as they come down to form the inguinal ligament. As the strap crosses the greater trochanter of the femur, there are pulls from below, coming from the leg, and from above, coming from the crest of the hip bone.

As was the case in the collar strap, some of the fibers of the pubic band run deep to the hip joint rather than across its outer surface, altering the way the femur tits into the hip socket. In addition, parts of the strap exist as a V-shaped thickening on the inside of the legs, along the pubic ramus. The strap is split—part of it goes between the legs and part goes around the legs.

The pubic strap is a complex weaving in and out of the bony structure at the base of the abdomen. Two internal cross-structures are located here—the pelvic and urogenital diaphragms. The internal extension of the pubic strap is continuous with the connective

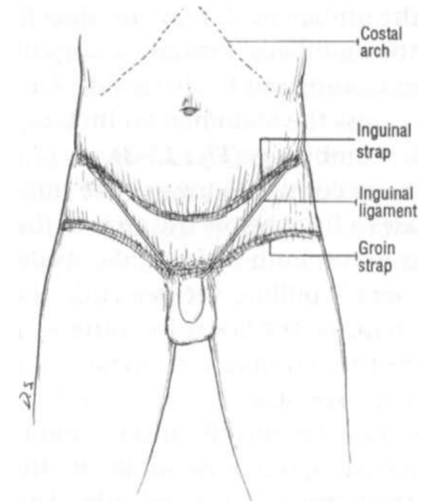


Figure 15-4
Groin strap, anterior view (also showing inguinal strap and ligament).

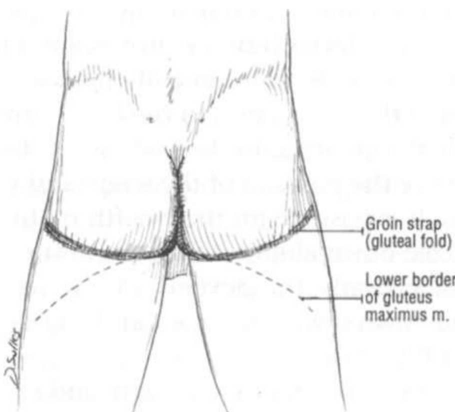


Figure 15-5
Groin strap, posterior view.

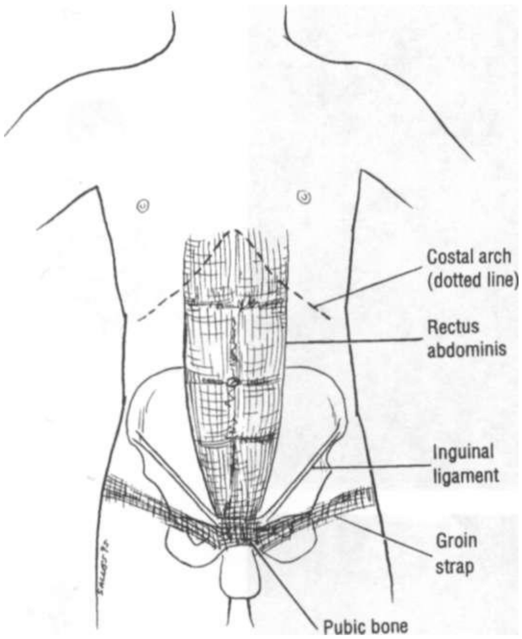


Figure 15-6
Groin strap with rectus abdominis.

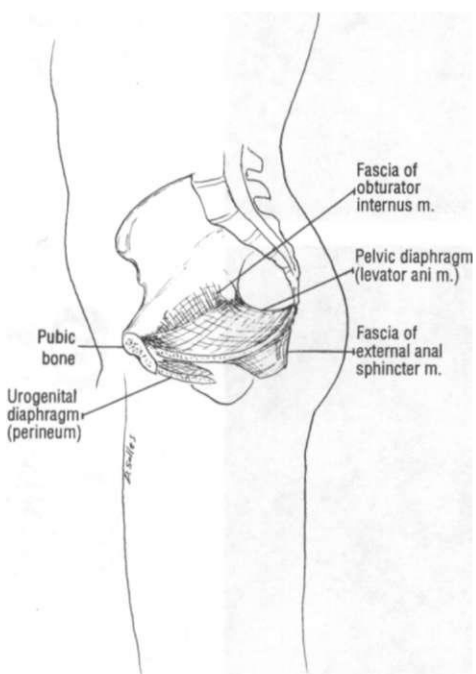


Figure 15-7
The pelvic and urogenital diaphragms.

tissue of both of these. In turn, these diaphragms are penetrated by, and continuous with, the musculature of the rectum, urethra, and vagina *(Fig. 15-7).*

The location of the tailbone is important because it is one end of support for the hammock called the pelvic floor. It is also, at its connection with the sacrum, the endpoint of the pubic strap. Unfortunately, the tailbone is one of the most vulnerable and accident-prone locations in the body. Children repeatedly fall backward onto their tailbones. In later life, accidents involving bicycles, roller skates, and many team sports seem somehow to focus on the tailbone and its aptitude for getting jammed. In general, we don't consider this damage—no bone is broken, it isn't serious. But this can be one of the longest lasting kinds of imbalance in the body. A wrenched tailbone has no support to pull it back into position; no one has ever seen a plaster cast on a tailbone. Most doctors, bodyworkers, and sports trainers don't think the coccyx is very important. To us, seen anatomically, it is reminiscent of the tip of an arrow. The V-shaped sacrum is the arrowhead, and the vertebral column is the shaft. The coccyx, like the arrow tip, guides the direction of movement; the spine compensates by flexion, extension, and rotation. When the pubic strap tightens down, it reduces flexibility, cementing the coccyx into a fixed attitude.

The pelvic and pubic straps have very heavy vertical interconnections in front and back. In front this is partly the continuation of the lower rectus abdominis fascia as it traverses the apron of the pelvic strap toward the pubic strap. It has sideways ramifications that thicken the inguinal ligament. In the back, the two straps are connected by a heavy pad on both the inside and the outside of the sacroiliac junction. This configuration, with the connections in front and back, and the straps between, gives a modified "jock strap" or "chastity belt" under the skin.

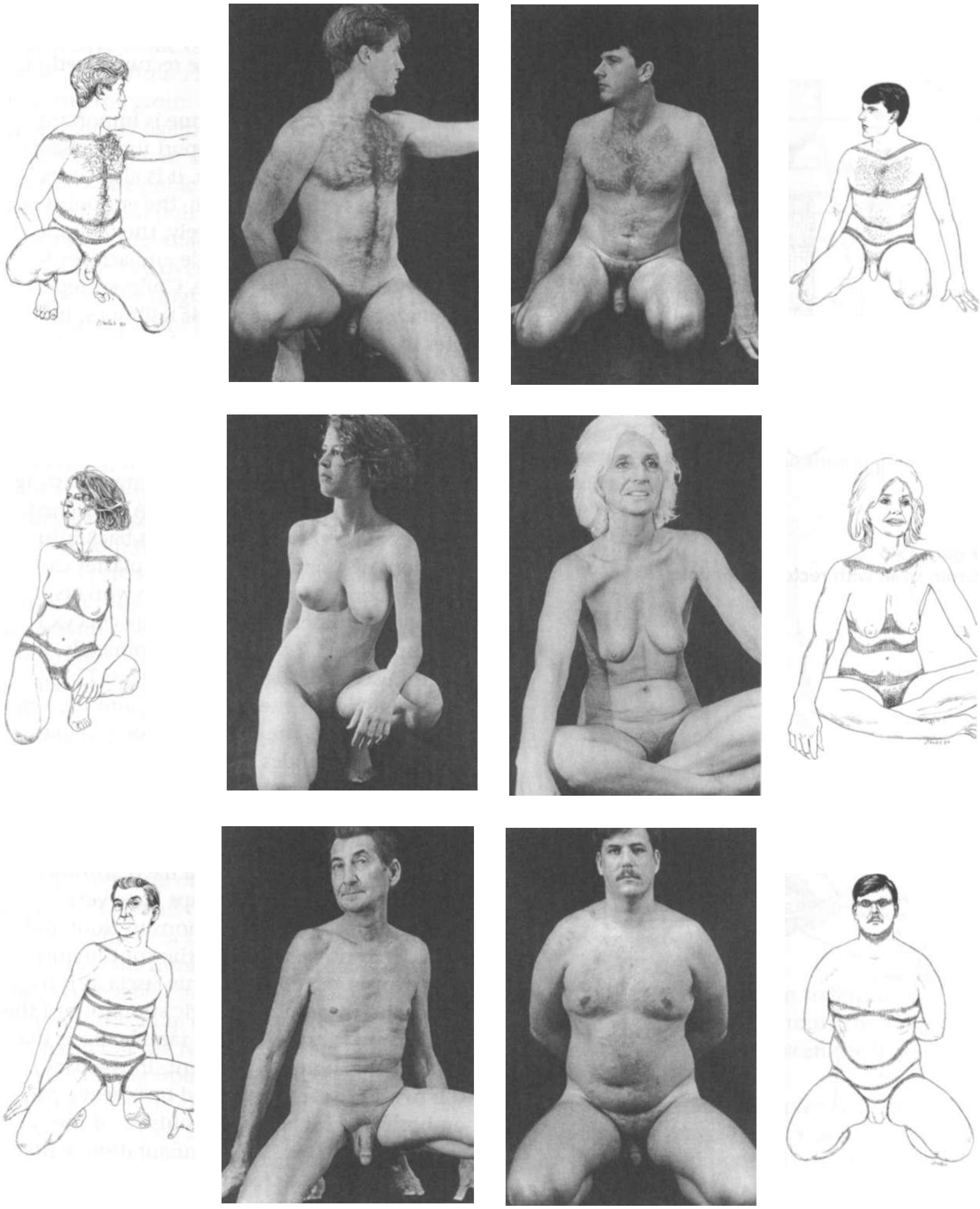


Figure 15-8

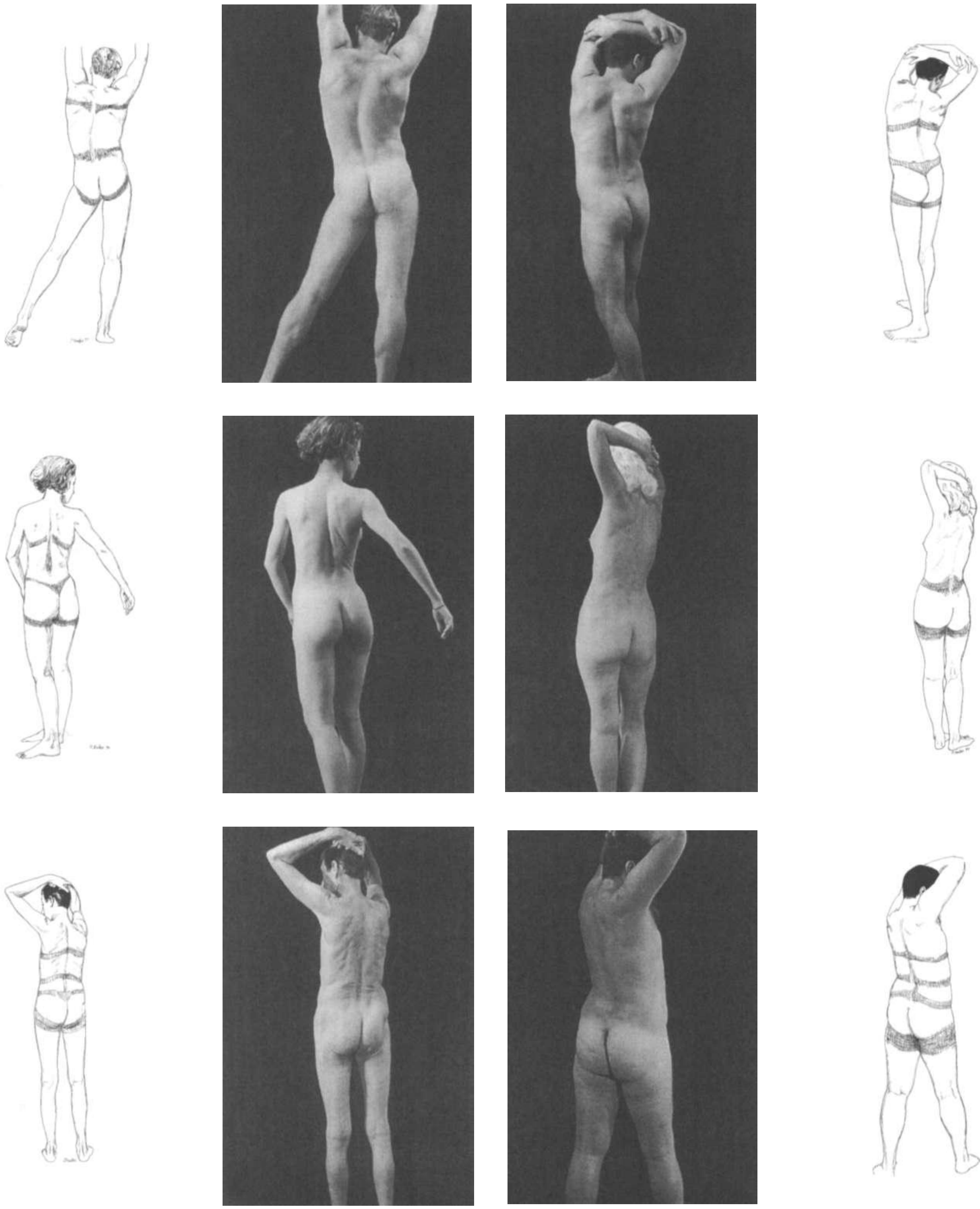


Figure 15-9

PART FOUR

Anatomy and Function

SIXTEEN

Proprioception

Internal Body Awareness

Movement can be evaluated from the outside by a trained observer. It is evaluated from the inside by proprioception. This is the internal physical sensation of position in three-dimensional space. Most of us can sense our bodies to some degree. When we tune in, however, it is surprising how many parts of our bodies we don't feel. For example, most people walk around with one shoulder higher than the other, one eyebrow higher than the other, etc. Yet we are rarely aware of this. We are startled when someone points it out, and usually find it difficult to sense even then. With some effort, we may feel our feet, but find it impossible to sense our ankles. We may be able to reach our lower legs, but somehow can't get a sense of our inner thighs.

The older we get, the more we tend to limit our body sense to what hurts. Children often seem to have a pleasurable sense of their bodies. Through training, accidents, and unwelcome sensations, adults learn not to take pleasure in their bodies. Everything from cultural taboos to unwanted emotions and painful memories (physical and emotional) teach adults to be less aware of their bodies.

Proprioception is the conscious part of body awareness. There is also an unconscious aspect of the body, and it is here that cultural body images are the most profoundly influential. Victorian ideas of "niceness" still exist in the modern guise of okay-ness. It's okay to feel my shoulders; it's less okay to feel my breasts, although it's more okay to feel my breasts when I'm alone than when I'm in public, and this is again different from breast self-examination. Little children are taught that it's okay, even wonderful, to tie your shoelaces and brag about it. It's much less okay to zip your fly and brag about that. It's okay as a teenager to be athletic and to show off your physical prowess. It's not okay to swank your hips or push out your breasts.

When we give up the freedom to feel our bodies in this way, it is not a freedom easily regained. The teenager who chooses not to feel movement in his or her hips may find as an adult that there is a loss of sexual feeling.

Pelvic movement, sexual identity, and the like are loaded areas of awareness. Even if we turn to something neutral, such as throwing a ball, proprioception of the movement will be defined by body image, movement image, accidents, and physical structure.

Proprioception is the summation of our physical history into the moment of present activity. As I throw a ball, I may feel my wrist snapping as the ball is released but have less awareness of how my elbow extends. I may feel my arm as I throw, but not how my arm connects to my back or how my back is supported through my pelvis and legs. In the Midwest, the term for this kind of whole body engagement is "body English." Every physical act reverberates through the whole body, and this can be consciously felt. Proprioception, then, is sensing the mechanics of movement. Where there is a gap in proprioception, there is a habitual inhibition of movement. This is anchored in the flesh by loss of elasticity in the connective tissue, a reduction in its ability to stretch and then return to its original shape. Releasing these contractions in the connective tissues is a matter of physical or mental awareness.

The straps inhibit physical responsiveness and proprioception. An image of how a strap would feel proprioceptively is a woman in the early part of this century wearing a corset. She has little or no articulation of movement between the top and bottom halves of her body. As she walks, undulation from her legs through her waist into her chest and shoulders is inhibited. When we do not feel movement in the waist or at the top of the pelvis, a similar structure under the skin occurs.

Connective tissue can harden to the point where it acts like a corset. We tend not to feel this as a restriction. If we did, it would be irritating. Instead, we simply feel the comforting familiarity of not being able to move our waists. It is not always possible to release structures like this by physical means alone. A Rolfer can set the stage for the release, but until the individual is ready to feel movement through the area, the only thing a Rolfer can do is allow the person to become more precisely aware of the area of holding. The letting go is done by the client.

Proprioception is filtered through perceptual style. There are people who are predominantly visual and those who are auditory. Visualizers tend to see and know about their external physical image. Auditory types compare what they perceive physically to verbal descriptions and are more often aware of internal structure and imbalances.

Often people are unwilling to occupy all of their potential space. They don't use their full chest, the full potential of their rib cage, or a full pelvis. Unconsciously, they shorten the body, develop curvatures of the spine, pull the legs into the hip, shorten the neck. Women often have thin arms; there may be an unwillingness to demonstrate the potential or power that is available in arms and shoulders. Men often have thin legs, perhaps a tightening of the legs in response to a tightening of the pelvis.

When people become aware of these gaps in proprioception and the accompanying habitual attitudes, they are surprised. Almost invariably, people sense their head as being much smaller than the actual physical structure. We usually feel our arms to be shorter than their length, or our legs, particularly the thigh bones, as shorter than they are. Possibly this reflects psychological assumptions about our capacity. There is also a physical result of this kind of attitude. When I'm not aware of the full space in my head, the skull bones compress. This shows as a narrowness at the temples, creating a head that is too long and too deep.

One indicator of the difference between reality and internal image is the sense of unfamiliarity when we're faced by a three-way mirror. We may be accustomed to our frontal image, but feel surprise at our profile and even more at our shape in back. It's worth noting here, too, that we are a "doing" society, oriented toward what is in front of us. As we see ourselves in a mirror, it is common to make automatic adjustments to "look better." We are apt to assume a "better" posture, pull our shoulders back, stand up "straighter." We are rarely at rest in front of a mirror.

Static proprioception becomes more complex in movement. Normally, we are in movement, and in movement the limitations of a structure become much more apparent. Structural aberrations and preferences are fundamentally a matter of holding some part rigid. When the body moves, it must move around the held place. When the hip is restricted, for example, effort has to be expended to hold it rigid while walking. Movements such as walking down the street or up steps, or eating at a table all show characteristic body habits.

Proportion and balance are the keys to movement. Anomalies in physical proportion or balance, whether seen from the outside or sensed internally, are signs of the connective tissue pattern under the skin, reflecting the connective tissue structure we have been talking about—the surface body straps, vertical holdings, diaphragms, and shelves through the body.

SEVENTEEN
Upper Body

There are many ways to analyze human structure. Osteopaths, orthopedists, physiatrists, and chiropractors see people in terms of bone placement—how straight the spine is, how well the alignment stacks up from heel to ear. General medical practitioners generally evaluate health in terms of the soft tissues—muscles, blood and nerve supply, internal organs. We are proposing another perspective—evaluation of the connective tissue bed of the body. This includes the conformation of muscle and bone but is not limited to these.

The straps we have described give a sense of how connective tissue can create structures that overlap and interconnect. The direction of the connective tissue is not determined by any one muscle or muscle group. Our purpose is to give an image of physiognomy that is more inclusive, more directly related to the experience of structure and to movement.

In order to discuss structure, we analyze the body roughly in terms of its upper and lower halves. The easiest way to begin talking about the upper body is to look at the position of the ribs. In most people, the ribs angle too sharply downward in front. Ideally the ribs would hang more horizontally, although normally there is always some slight angle.

The typical body configuration that accompanies depression of the upper ribs includes a sunken and flattened upper chest, elevated shoulders, and a head thrust forward. These three go together. If the upper ribs were raised in front, the shoulders would automatically drop and the head come back to a more upright position. Likewise, if the focus is on bringing the head back, it is necessary to allow more space for the breath to come up into the upper ribs. Or if the shoulders relax, space is made for the head to come back and the ribs in front to come upward. For each person, the initial change is different. But for one of these habits to be modified, the other two must change as well.

The position of the head, upper chest, and shoulders is not separate from the rest of the body. When the upper ribs are compressed, very often the lower ribs are overexpanded. The extreme of this is the pear-shaped body, in which the lower ribs flare outward while the upper ribs are so compressed that the shoulders are drawn together and narrow.

It is the soft tissue configurations that give rise to these silhouettes. A more detailed anatomy of the chest and upper back is needed to flesh out our point. The connective tissue conforms to the muscle. In fact, it would be more accurate to say that the connective tissue guides the muscle pathways. Furthermore, it is convenient to say that muscle attaches to bone, but this is not strictly true. The connective tissue extensions around muscles (tendons, aponeuroses) continue on as the connective tissue covering of bone (periosteum). Bone and muscle lie embedded within the connective tissue web.

In the front of the chest, the major muscle of the outer layer is the pectoralis major, the "pecs" that muscle builders attempt to develop ***(Fig. 17-1).*** It is a large fan-shaped muscle covering the majority of the upper chest, extending from the middle ribs up along the side of the breastbone and the middle half of the collarbone. The fan converges across the shoulder in front, and ends by attaching to the humerus an inch or two below the shoulder joint.

In the back, there is the trapezius, the weightlifter's "straps" ***(Fig. 17-2).*** This originates from the back of the skull and runs

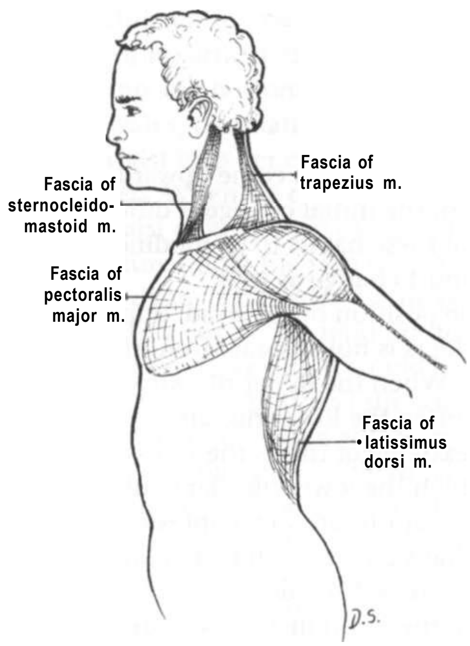


Figure 17-1
Anterior arm and shoulder fascia.

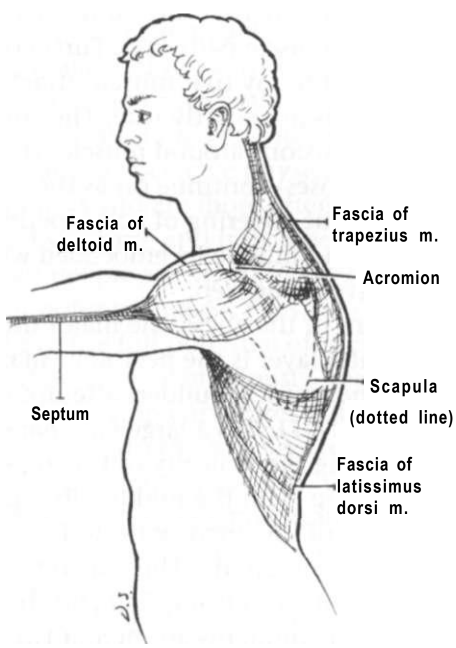


Figure 17-2
Posterior arm and shoulder fascia.

along the back of the spines of all the neck vertebrae and the upper seven or eight chest vertebrae. It, too, is fan-shaped, converging on an attachment to the tip of the shoulder called the acromion. The acromion is a bony shelf that can be palpated at the corner of the junction between the shoulder and the arm. The lower part of the trapezius, as it crosses the shoulder blade (scapula), also attaches to the acromion as well as to the scapular spine.

In the back, another large fan-shaped muscle flows up from below, called the latissimus dorsi—the weightlifter's "lats." It attaches to the spines of the lower chest vertebrae as well as to the spines of the lumbar vertebrae down to the sacrum. The point of this fan converges upward, obliquely crossing over the lower tip of the shoulder blade. It then runs along the lateral margin of the shoulder blade and ends by attaching to the humerus (arm bone) just behind the attachment of the pectoralis major.

These three muscles make up what we call the external muscle and connective tissue layer of the chest, relating the chest to the shoulder and arm, to the head, and to the lower back. The next layer, which serves to stabilize the position of the shoulder blade, is more difficult to visualize as a layer. In the front, underneath the pectoralis major, lies the pectoralis minor ***(Fig. 17-3).*** This is a narrow small muscle that attaches to the middle ribs and angles upward to attach on the coracoid process. This hook-like projection forward from the inside of the shoulder blade can be felt just underneath the collar bone, in the depression between the larger arm muscles and the sides of the ribs.

The pectoralis minor acts like a lever on the coracoid process, moving the shoulder blade. The coracoid process is very much like a hook on a suspended metal plate (the scapula). When the hook is tugged near the top, the lower border of the plate is raised like a drawbridge. If the pectoralis minor in front is habitually tight, the pull on the coracoid process results in what we call "winged" scapulae in the back *(Fig. 17-4).* The medial margin of the shoulder blade will project outward.

Two other attachments to the coracoid process are connected down into the arm. The short head of the biceps brachii (commonly called simply the biceps) crosses both the shoulder and the elbow joints. Thus, tightness in this muscle on the front of the arm will also reposition the scapula. The coracobrachialis is a shorter muscle that spans from the coracoid process to the inside of the humerus about halfway down the arm, reinforcing the action of the biceps on the scapula *(Fig. 17-3).*

A ligament from the coracoid process to the underside of the clavicle contains the subclavius muscle, a small muscle whose function is traditionally considered minimal. Called the coracoclavicular ligament *(Fig. 17-3),* its function is probably a factor in the normal positioning of the scapula. To us, this is not a ligament, but a tendon through which the subclavius muscle is attached to the coracoid process. The action of the subclavius through this connective tissue attachment is not great in terms of movement. Its importance lies in the way it stabilizes the fascial sheath of the chest as a whole. There is an analogous structure in the leg. This is the muscle and attached fascial bridge called the tensor fascia lata and iliotibial band. The band is a lateral thickening of the fascia covering the thigh as a whole (the fascia lata). The action of the comparatively small tensor muscle serves to stabilize the whole of the thigh *(Fig. 17-5).*

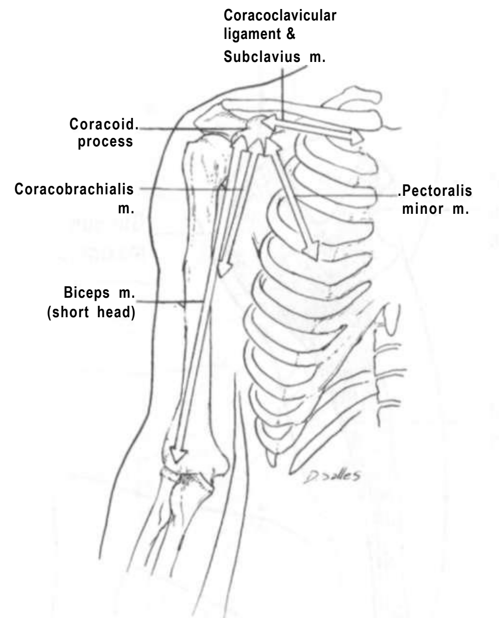


Figure 17-3
The deeper layer of the chest muscles; the arrows indicate the line of force of these muscles. The focus here is on the coracoid process of the scapula and therefore includes lines of force of the relevant arm muscles.

Figure 17-4
In this pose, the pectoralis minor is contracted; the result is a "winged" scapula.

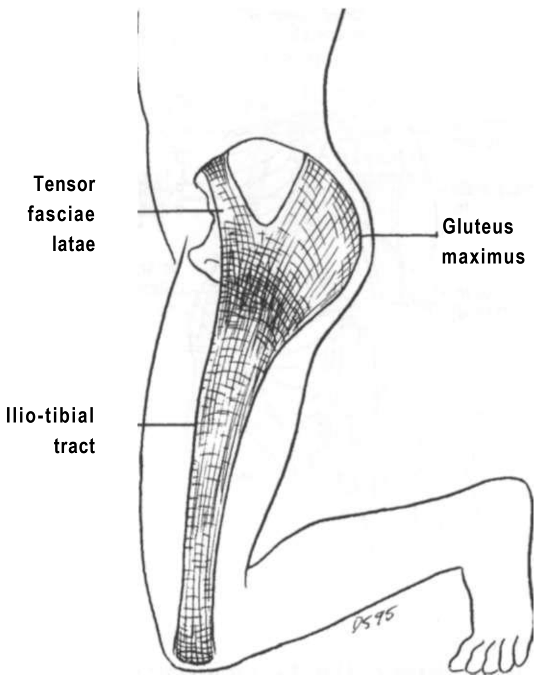


Figure 17-5
Connections between knee and hip.

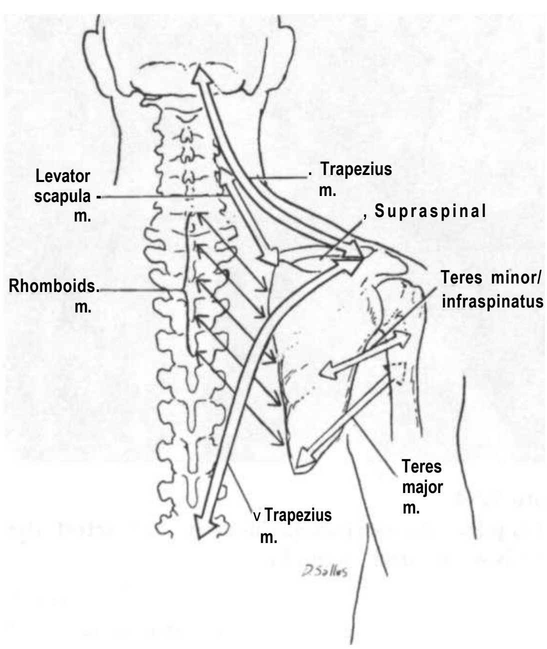


Figure 17-6
Scapular suspension.

By identifying the muscles that connect to the coracoid process, we can visualize the fascial involvements. From the coracoid process, there are strong connections to the middle ribs, to the radius and ulna of the forearm, to the humerus of the upper arm, and to the middle clavicle. Tension on any or all of these will result in a degree of immobilization between the upper chest and the arm and the position of the scapula in the back. Movement through a fascial plane is always broader than movement by an individual muscle.

On the back, the shoulder blade is suspended in three places. On its surface, the trapezius connects to its most lateral tip, primarily at the acromion. At a deeper layer, the rhomboids and the levator scapulae form a broad sheet of attachment to the medial ridge of the spine. Also in this deeper layer, the two teres muscles, major and minor, connect the scapular triangle to the upper arm ***(Fig. 17-6).***

The scapula is thus suspended from all of its sides: from the head by way of the trapezius, from the thoracic spine by way of the rhomboids and levator, and from the upper arm by way of the teres. The elasticity of the connective tissue of each of these allows the shoulder to float on top of the rib cage. The tightness of any of these will engender tightness in the others and will fix the shoulder blade. This, in turn, will reduce the flexibility of the neck and head, the upper back, and the arm.

Rhomboids and teres between them form a sling that stabilizes the movement of the lower part of the scapula. When the arm moves sideways, the distance between the arm bone and the scapula widens and the teres should be able to lengthen. When the muscles reach the limit of their elasticity, the shoulder blade will start to move sideways. Its movement is stabilized by the elasticity of the rhomboids. If the shoulder blade is winged out, the teres must then also try to stabilize the lower margin of the shoulder blade to prevent it from moving too far out, away from the flat of the ribs. The teres were not designed for this purpose, and so they shorten. The surrounding connective tissue becomes overtense. When the teres lose elasticity, the shoulder blade is dragged along with every arm movement.

Many people's teres are much too short and tight. The other half of the sling for the scapula, the rhomboids, then are less used and become flaccid. Higher up, the levator scapulae becomes extremely tight, forming a heavy pad. The attachment of the levator on the upper middle corner of the scapula is that place where, if you press it on almost anyone, he or she will sigh, "Oh, that hurts so good!"

Another muscle of the middle layer, the serratus anterior, connects the lower ribs to the underside of the scapula *(Fig. 17-7)*. Both serratus anterior and subscapularis lie between the rib cage and the shoulder blade. The serratus attaches on the lower ribs and angles upward toward the medial border of the scapula, attaching just adjacent to the attachment of the rhomboids. The subscapularis lines the underside of the shoulder blade, with its fibers converging toward the fibrous capsule of the shoulder joint. These form another reciprocal set of slings, floating the shoulder blade between the ribs and shoulder joint. Normally, the function of the serratus anterior seems to be to stabilize the shoulder blade as the arm swings overhead. Its fascia often glues the muscle to the periosteum and fascia of the ribs and intercostal muscles.

Two small muscles on the outer surface of the scapula, the supraspinatus and infraspinatus *(Fig. 17-6)* further refine the movement of the shoulder blade in relation to the shoulder joint. These lie on the surface of the scapula, above and below the scapular spine. In palpation, they often feel like bone when the shoulder blade is in trouble.

We have been talking about how the

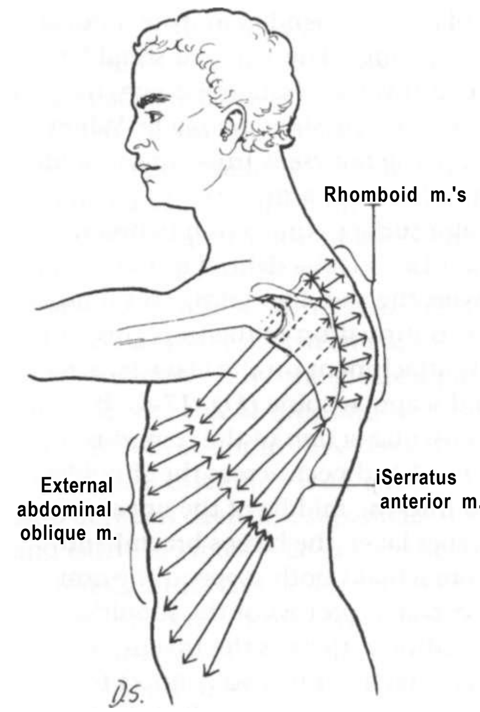


Figure 17-7
The subscapularis (not shown) lines the undersurface of the scapula. Its direction of pull is roughly perpendicular to that of the serratus anterior.

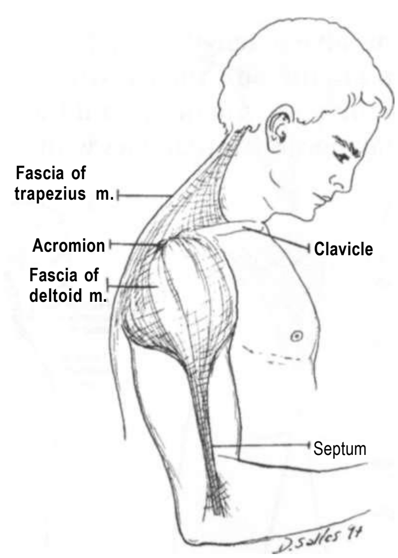


Figure 17-8
The deltoid fascia interweaves with the septum dividing the anterior (biceps) and posterior (triceps) areas of the arm.

shoulder blade is suspended in its reciprocating muscular slings. The arm and shoulders also relate in this way. Hanging down, the arm swings from the shoulder blade. When we reach up, the reverse is true—the shoulder blades hang from the arm.

The major surface connection between shoulder and arm is the deltoid muscle, which covers the shoulder joint. This muscle acts like a continuation of the trapezius, embracing its attachment on the clavicle, acromium, and scapular spine ***(Fig. 17-8).*** It extends muscular action of the trapezius from the head and neck across the shoulder and down into the middle of the upper arm.

At a deeper layer, the biceps brachii and the coracobrachialis both suspend the arm from the coracoid process of the shoulder blade. In addition, there is the triceps brachii. Of its three attachments, two connect to the humerus itself and one—called the long head—connects to the outside margin of the shoulder blade just below the shoulder joint.

These three muscles govern the lengthening out of the arm from the shoulder blade. The arm should be able to lengthen as it is raised upward and to the side, such as when stretching your arms wide and up toward the ceiling in the relaxing stretch that goes with a yawn. Note that in this kind of stretch, the shoulder blade is suspended from the arms.

There are two major factors to consider in arm movement—the movement of muscles over the tip of the shoulder blade and movement in the armpit. Ideally, the arm can be raised without elevating the shoulder blade, which drops as a counterbalance. In addition, the arm must be able to freely move away from both the rib cage and the shoulder blade.

There is no way that we can freely use an arm without opening the armpit, yet armpits are the focus of a wide variety of emotional concerns. We have all sorts of reasons why we don't want to be, in effect, that open. Protective gestures, fearful gestures, holding one's breath, angry gestures all focus on tightening the arms down to the ribs. These are gestures repressing response to emotion. We are inhibiting what we would like to do with our arms: warding off anger, fear, resentment, etc.

Trapezius, deltoid, pectoralis major, and latissimus dorsi are commonly called the extrinsic (outer) muscles of the shoulder area, connecting the arm and trunk. To simplify, we can think of the trapezius and deltoid as a single, functionally continuous structure ***(Fig. 17-9 A).*** These are the muscles that raise the arm. The latissimus dorsi and pectoralis

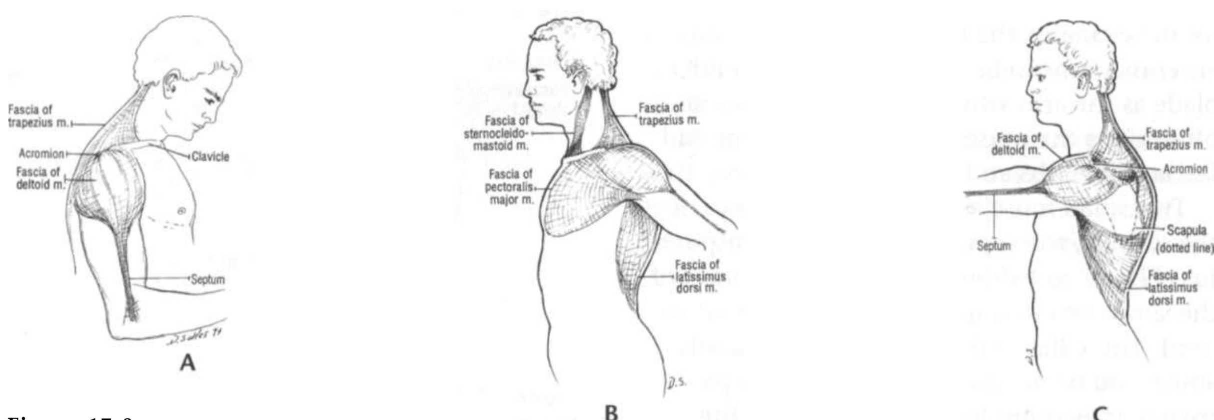


Figure 17-9
Shoulder and arm movement depends on the continuity of fascia—(A) lateral shoulder, (B) anterior shoulder, (C) posterior shoulder.

major, acting together, bring the arm down *(Fig. 17-9 B & C).* These muscles of the outer (extrinsic) layer counterbalance each other. For example, when the arm is raised to the side, deltoid and trapezius contract as pectoralis major and latissimus dorsi relax, allowing the arm to extend away from the body. As the arm returns to the side, pectoralis and latissimus contract as trapezius and deltoid lengthen.

Two kinds of movement are possible here—dropping the arm, which is faster, or sequentially letting the arm down, which is slower. In both movements, one set of muscles contracts. The difference between the two movements is in the counterbalancing set of muscles. When the movement is fast, the opposing muscles simply let go and the connective tissue bed elastically stretches. When a movement is slow and controlled, the antagonist muscle lengthens sequentially. It acts as a brake to modulate the movement. In either fast or slow movements, the ultimate limit on the movement will be the limit of elasticity of the connective tissue bed.

What we call sequencing in muscle movement is a factor in how the large flat surface muscles are used. For example, as the arm is raised, the first muscle activity starts at the portion of the trapezius between neck and shoulder and continues down the deltoid. As the arm comes further up, muscle activity concentrates further down the trapezius. The continuing upward movement of the arm is supported by the vertebrae because of the action of different parts of the trapezius. Anatomical nomenclature occasionally reflects this stepwise use of the surface muscles by dividing them into specifically named sections.

Ideally, in no movement do we use all fibers of a muscle simultaneously. At the deeper layer of fascia and muscle, sequencing moves through a series of muscles rather than through the plane of one muscle. This is as true of very small muscles as of larger sheet-like ones. Part of the way heavy immobile tissue pads are created is by our insistence on trying to use the muscle as a whole instead of sequencing through the muscle as body position demands. A major source of confusion in the practical application of kinesiology is that no muscle exists in isolation. The connective tissue bed provides connections between muscle layers as well as between adjacent muscles. These interfaces have the greatest potential for adhesion, thickening, and shortening. Elasticity of the connective tissue between structures is essential for an effective relationship between deep and superficial (intrinsic and extrinsic) muscle layers. In the front, pectoralis minor lies under pectoralis major. Toward the center front, both muscles affect the action of the ribs. In the shoulder, the pectoralis minor attaches to the coracoid

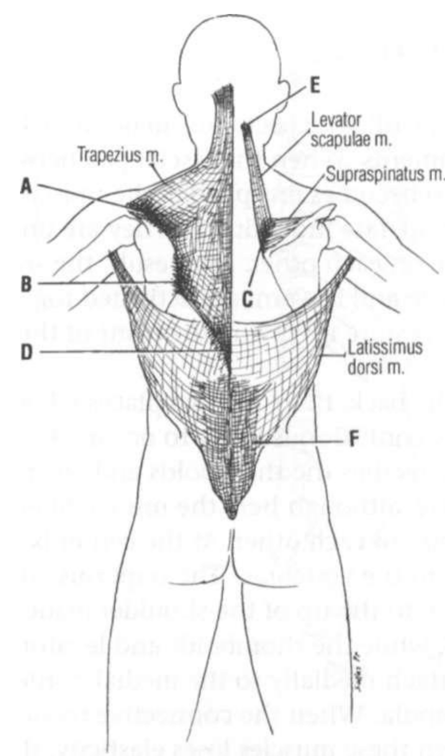


Figure 17-10
Common "knots."

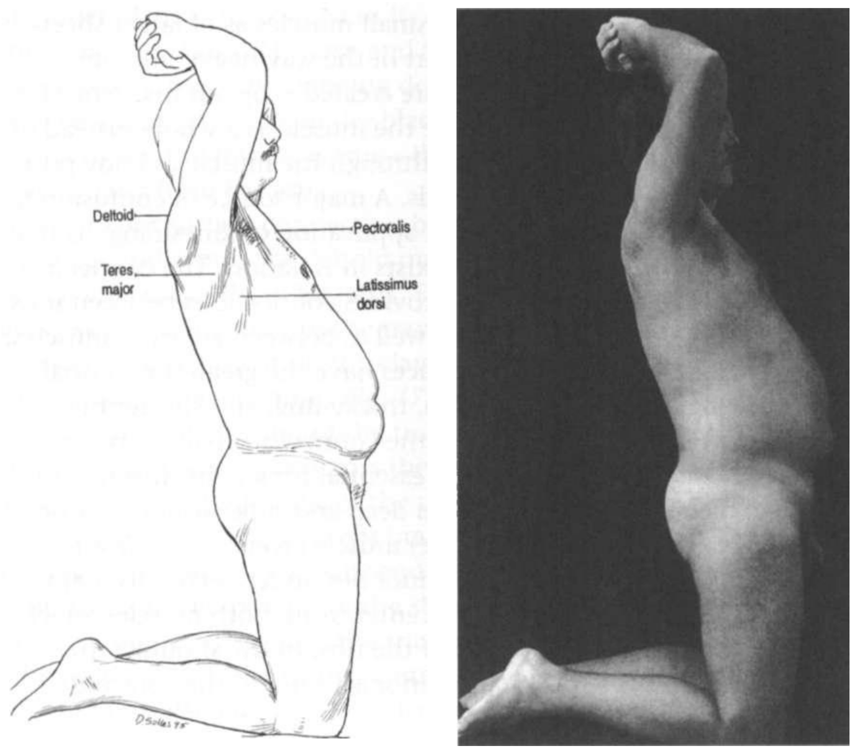


Figure 17-11

process while the pectoralis major attaches to the humerus. When the fascial pad between the two becomes less pliable, the muscles no longer operate individually. They are unable to slide on each other. As a result, the shoulder blade and the arm are activated together in any gesture involving the front of the chest.

In the back, there are two places where this kind of confusion is likely to occur. The trapezius overlies the rhomboids and levator scapulae, although here the muscle fibers run crosswise to each other. At the center back, all attach to the vertebrae. The trapezius attaches laterally to the tip of the shoulder blade (acromion), while the rhomboids and levator scapulae attach medially to the medial border of the scapula. When the connective tissue bed between these muscles loses elasticity, the shoulder blade cannot rotate. Its only option is to be shrugged up. This is a factor in that mid-back place under the lower tip of the shoulder blade that is so often painful.

Another mid-back place on the spine that is commonly painful is where the lower tip of the trapezius crosses the uppermost attachment of the latissimus to the vertebra. ***(Fig. 17-10).*** This spot almost always contains a sensitive knot of tissue. This is in the area that we have been calling the dorsal hinge. The part of the latissimus toward the humerus lies immediately adjacent to the teres major. The teres major is a bridge between the lower tip of the scapula and the armbone. The latissimus connects the arm bone to the lower back and the pelvis. We frequently see latissimus and teres major bound together, with the result that the lower tip of the scapula is immobilized. These interactions are conceptually straightforward and give a partial picture of the effect of the connective tissue on movement between arm, shoulder blade, and ribs. For a more complete and complex view, we recommend consideration of the effect of connective tissue on the underside of the deltoid. This muscle overlies attachments of the teres major and minor, pectoralis major and minor, biceps brachii, coracobrachialis, and infraspinatus.

Our anatomical illustrations in this section attempt to depict the interactions of muscle, bone, and connective tissue in movement. The interactions with the deltoid are too complex to show in two dimensions ***(Fig. 17-11).***

EIGHTEEN
Axial Skeleton

We have not yet talked about the long muscles of the spine, which are also a part of the soft tissue layers of the upper body. Collectively, these are called the erector spinae, and they travel the length of the spine from the skull to the sacrum *(Fig. 18-1).* In both appearance and structure, they are much like a multistrand rope. The muscles closer to the outer surface of the body are longer; as we go progressively deeper through the layers, muscle segments become shorter and shorter. The deepest muscular layer connects one vertebra to the vertebra immediately above it.

The heavy fascial sheath covering all of the erector spinae is called the lumbo-dorsal fascia *(Fig. 18-2).* It continues upward to the neck and to the occipital ridge. Below, the lumbo-dorsal fascia is continuous with the sacral pad and ends on the coccyx. This fascia is very heavy; it acts as an aponeurosis (broad attachment), connecting the latissimus dorsi to the lower half of the spine. Above, the fascia is less heavy; it lies under the middle muscle layer (rhomboids and levator scapulae).

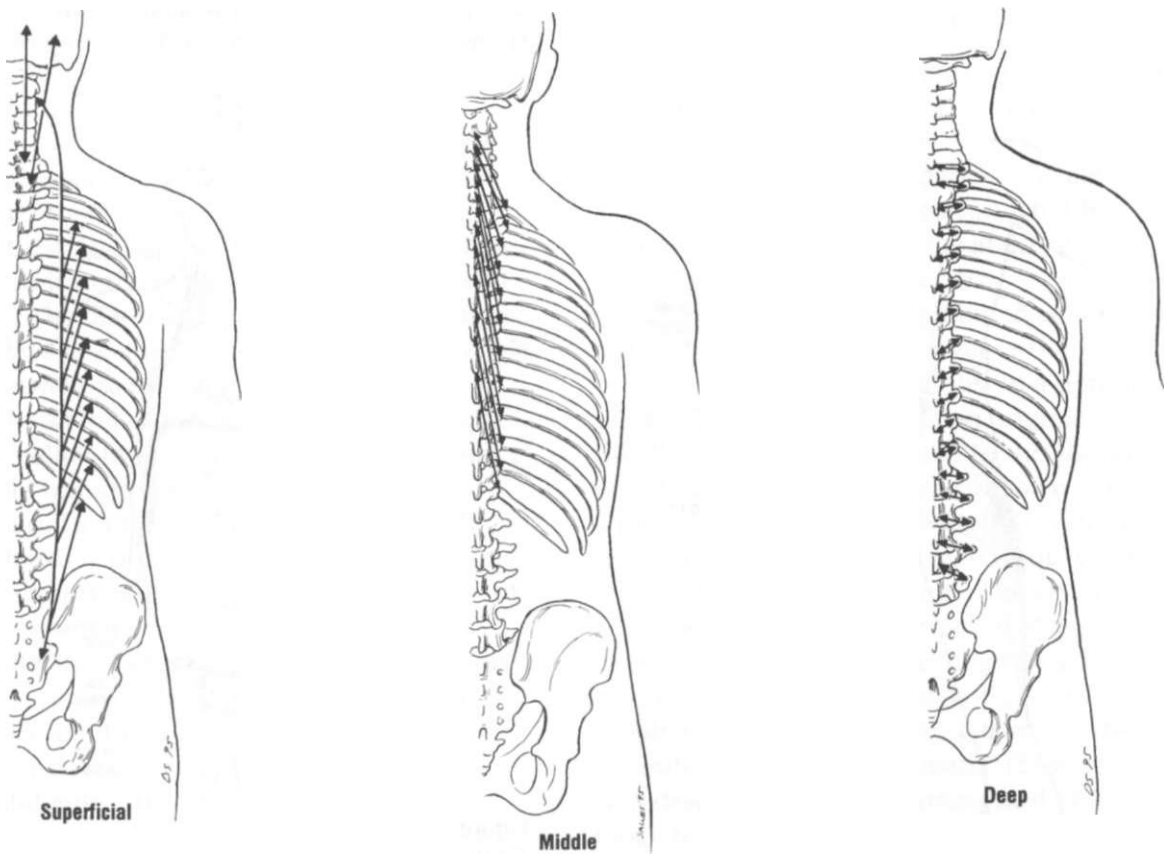


Figure 18-1
In these schematics of the erector spinae, the arrows indicate the direction and length of muscle groups. The most superficial muscle groups are the longest, while the deepest are very short.

Upper back and shoulder problems are usually interconnected through this fascia, which feels like a glass plate when it is in trouble. In the lower back, restriction in the lumbodorsal fascia will show as a longitudinal rope-like rigidity, sometimes modified by a cross-pull from the latissimus dorsi.

At the deepest level, there is a connective tissue continuity that includes the joint capsules and the periosteum that ensheaths each bone. In the chest, this layer continues both inside and outside the rib cage and contains the intercostal muscles between the ribs. This fascia is continuous with the fascia positioning the internal organs, not only surrounding the organ but penetrating through it. This is particularly apparent in the lungs, where connective tissue surrounds the branching system of trachea, bronchi, bronchioles, and even alveoli.

The connective tissue on the inner surface of the ribs and intercostal muscles is continuous with a vertical connective tissue septum that divides the right and left sides of the chest cavity ***(Fig. 18-3).*** This is called the mediastinum. It connects the underside of the sternum (breastbone) to the vertebrae of the chest region. The mediastinum contains the heart. It should be elastic enough that heart movement can be accomplished without inhibition. Furthermore, this connection between front and back of the chest must also be able to adjust with each breath. When there is tension and vertical shortening of the

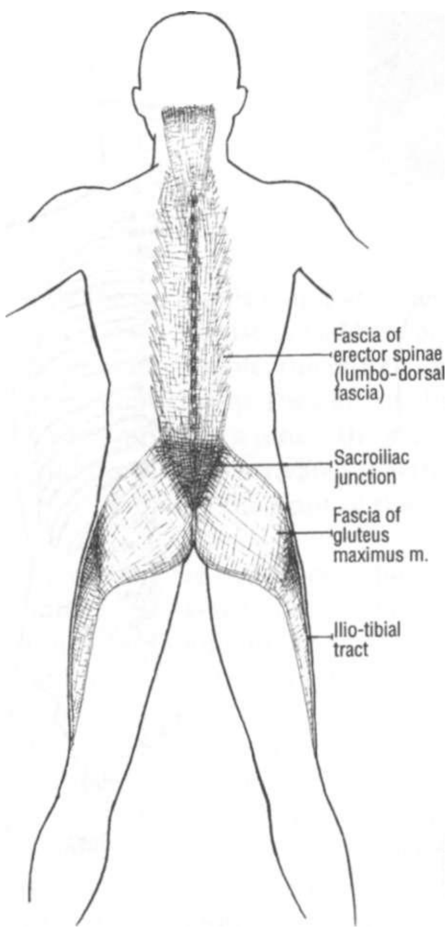


Figure 18-2
Continuity of fascia of erector spinae and gluteals.

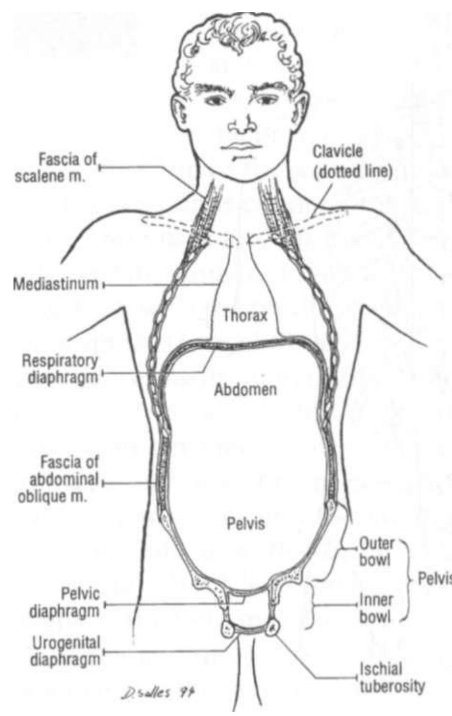


Figure 18-3
Continuity of fascia within the body cavity. The diaphragms of the body cavity: one at the clavicles, the respiratory diaphragm, the two pelvic diaphragms.

mediastinum, both heart function and breathing are hindered. Externally, tension in the mediastinum is visible as a chest that is too thick from front to back—a barrel chest. In a chest that is too narrow from front to back—a concave chest—the mediastinum and heart are pushed off to the left, which again will create tension on the heart. Displacing the heart then constricts the lung and restricts breathing.

At its lower margin, the mediastinum is continuous with the connective tissue of the diaphragm. The diaphragm is an approximately horizontal curved layer of muscle that divides the chest cavity from the abdominal cavity. It is made up of a heavy circular central tendon surrounded by a ring of muscle. The muscle flares outward from this central tendon and blends into the muscle wall of the chest and abdomen.

The diaphragm attaches to the inner margin of the rib cage (the costal arch) and extends sideways to the tips of the free ribs, the tenth, eleventh, and twelfth. It crosses the tip of the very short twelfth rib and then blends into the oblique muscles of the abdomen. The diaphragm is thus not quite horizontal across the body; it has an oblique angle downward to the back.

The action of the diaphragm is like a sail that bellies in the wind ***(Fig. 18-4).*** Its middle bellies up into the chest cavity with each exhale (1); it flattens with every inhale (2). With exhalation each rib is raised by rotating in its joints with the vertebrae. As the ribs lift and expand the chest, air enters the lungs. Ideally, the diaphragm is lifted at its margins as the ribs rise and expand sideways with inhalation. In order for this to happen, the abdomen must lengthen when inhaling.

Abdominal breathing is often depicted as a pattern in which the abdomen protrudes in front with each inhale. Many disciplines teach a type of abdominal breathing that is anatomically questionable. For the abdomen

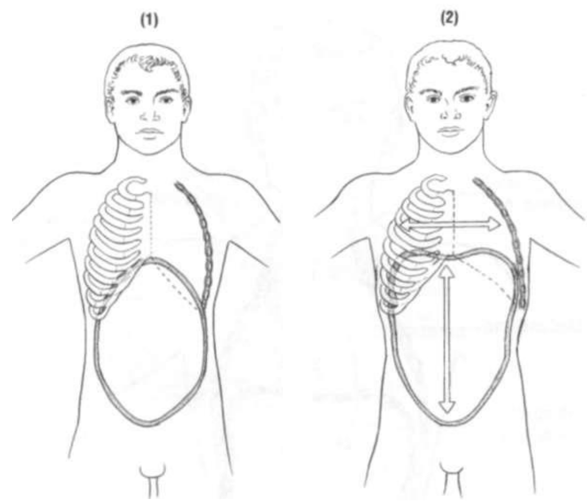


Figure 18-4
The action of the respiratory diaphragm.

to protrude in this way, it must shorten when inhaling. This is a learned pattern, one that is mentally controlled. Movements that are mentally controlled lack adaptive flexibility. The tendency is to over-focus on what has been learned. In this case, the abdomen is moved in preference to the ribs.

Exhaling involves the combined action of the diaphragm and one layer of the intercostal muscles between the ribs. In a normal, unforced exhale, muscle action originates in the diaphragm and continues to the abdominal obliques. This brings the rib down and allows the diaphragm to recoil to its normal dome shape up into the pleural (lung) cavity. Air is pushed out of the lungs. The system is not dependent on the presence of a lung. Even people with only one lung can achieve normal chest movement on both sides.

Rib action during breathing involves three separate types of rib movement. These are well described in most anatomy and physiology texts. We would like to emphasize the need for each rib to move separately and freely. If any one rib fails to maintain its portion of the chest contour, adjacent ribs and

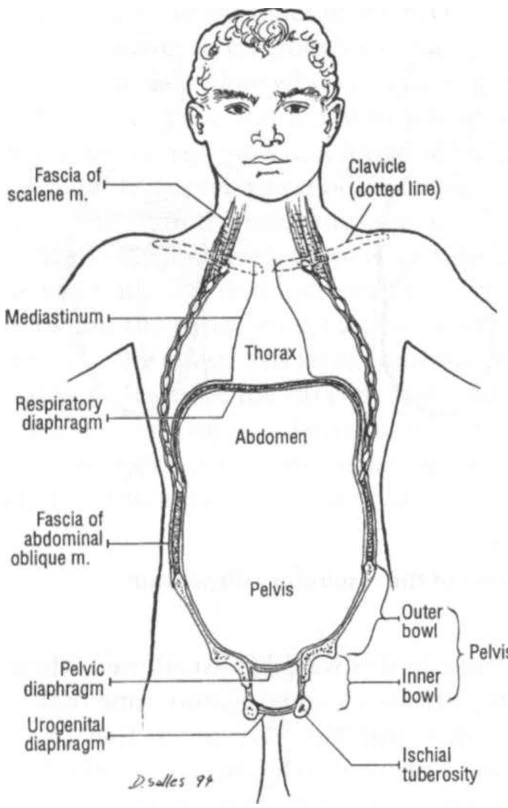


Figure 18-5
Diaphragms of the body cavity.

eventually the whole rib cage are distorted. If this process reaches a critical level, there is a general connective tissue response. This can be felt as an overall rigidity in the connective tissue of the chest, which feels almost like a strait jacket under the skin.

Filling the space in the notch between the clavicle in front and the heavy musculature of the neck and shoulder blade in the back are the scalenes ***(Fig. 18-5).*** These are the muscles in the depression on either side at the base of the neck. They attach to the upper ribs. The lungs extend up just underneath them. The scalenes serve a function analogous to that of the respiratory diaphragm, expanding and contracting when breath enters the upper tip of the lung. Since the scalenes attach to the processes of the neck vertebrae, tension in the neck restricts breathing in the uppermost part of the lungs. And tension in the neck has reached endemic proportions in our overachiever culture.

The neck can be seen as a continuation of the connective tissue structures of the chest. All structures in the neck have a broader continuation below, much in the way a plastic bag is gathered together with a twist at the top. The deepest layer of the neck includes the continuation of the erector spinae; the middle layer includes the scalenes. The outermost surface layer consists of the trapezius and the sternocleidomastoid.

The sternocleidomastoid extends from the base of the skull just behind the ear (mastoid process) down to the connection between the clavicle and the breastbone (sternum). It often becomes very prominent in older people from overuse in moving the head. Ideally, this pair of muscles only stabilizes the movements of nodding the head and turning the head from side to side. When the head is habitually pitched forward, as is too often the case, the upper trapezius becomes a primary support of the head. It is used to hold the head on, and it loses much of its functional role in head movement. The sternocleidomastoid then takes on almost the entire function of the trapezius.

The connective tissue of the outer layer of the neck is continuous with the connective tissue of the jaw. The pad over the angle of the jaw ties into the sternocleidomastoid ***(Fig. 18-6).*** It can act as an inhibitor to the freedom of movement in the jaw and so indirectly affect movement of the head as a whole. If you clamp your jaw as a habit, you will also be clamping your head. If you clamp your jaw hard enough, it will be difficult to shake your head "no," and also difficult to shake your head "yes." The fascia on the underside of the jaw is continuous with that of the tongue. The inside of the mouth and tongue are thereby included in restrictions of the face and head.

The erector spinae extend up to attach to the base of the skull, mingling with the heavy pad that is found on the back base of the skull. On the back of the neck, the fascia of the sternocleidomastoid and trapezius is continuous with the skullcap of connective tissue on the head. At the deepest level, along the spines of the neck vertebrae and up onto the bump on the back of the skull, there is a very heavy rope of connective tissue fibers. This is known as the ligamentum nuchae ***(Fig. 18-7).*** It fans out over the projection at the back of the skull (occiput), forming almost a T shape. It acts like a septum in the back of the neck, dividing right and left halves of the neck into separate compartments. Its action as a septum serves to connect the superficial and deep layers of muscle to each other in the back. This ligament becomes especially thickened, almost bony, in people who habitually thrust the head forward.

The septum of the ligamentum nuchae is a normal connection between outer and deeper layers of soft tissue. There are similar septa elsewhere in the body. They provide additional strength because a ligament is denser and more stable than its fascial counterpart. Septa also divide and compartmentalize function by separating myofascia.

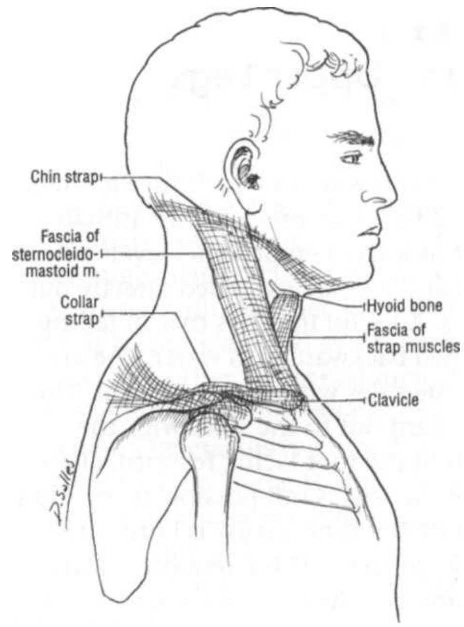


Figure 18-6
The connective tissue of the outer layer of the neck.

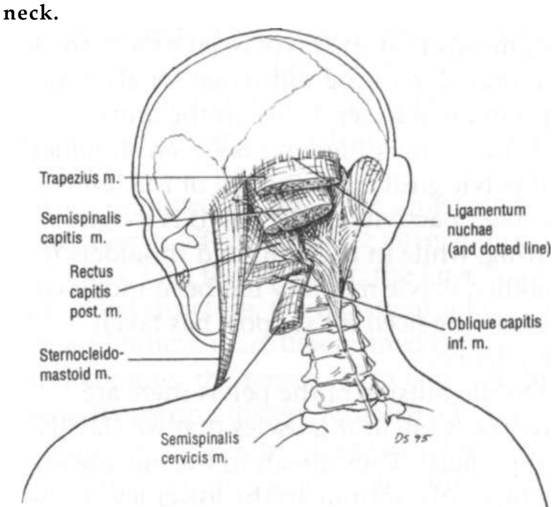


Figure 18-7
The ligamentum nuchae forms a surface covering for the muscles on both sides at the base of the skull. It then dives deep to form a septum between the right and left muscle masses.

NINETEEN

Pelvis and Upper Legs

There are several ways in which the shoulder and pelvis differ from one another. Initially, in the first month of embryonic development, both arms and legs are extended directly out to the sides. A useful image is that of falling spread-eagled backward into water. The arms are out to the sides with palms forward. The legs are straight out to the sides with the inside arch of the foot facing forward. (This position of the legs is not possible to an adult structure.) By the time a baby is born, the arms are down to the sides, retaining a wide range of motion. The legs have come down beneath and in line with the trunk. They are rotated so that the knee, which originally pointed headward, is now facing forward. This means that the myofascial web of the leg has rotated, creating soft tissue spirals in the legs (and to a lesser degree in the arms).

A functional difference between shoulder and pelvic girdle is in the use of the limbs. The major activity of the pelvis is weight-bearing, while in the arms and shoulders it is mobility. Pelvic mobility has been modified because the need for support has taken precedence.

On the outside of the pelvis there are three, possibly four muscles that we classify as superficial. They attach to the outside of the hip and continue to the lower leg. These are the gluteus maximus, the tensor fascia lata, and the sartorius. The rectus femoris is the fourth candidate for this classification *(Fig. 19-1)*

The gluteus maximus has a very wide attachment centrally, from the posterior margin of the ilium and from the sacroiliac junction down to and including the tailbone. The muscle angles diagonally across the pelvis down toward the leg, ending in the long fibrous track called the ilio-tibial tract. This tract ends on the lateral protrusions of the tibia and fibula, below the knee. In normal function, the gluteus maximus acts between the back part of the hip and the lower leg, bypassing the femur. Very often, however, as the gluteus maximus passes over the hip, it sticks to the greater trochanter, creating an aberrant drag on the femur.

The small tensor fascia lata attaches on the anterior superior iliac spine, which is the uppermost bony protrusion on the front of the pelvic curve. The muscle angles down and sideways, blending into the fibers of the ilio-tibial tract. Frequently, the tensor feels like bone. This tiny muscle balances the backward pull of the massive gluteus maximus on the ilio-tibial tract. By design, the action of the muscle is all along the tract, down to its

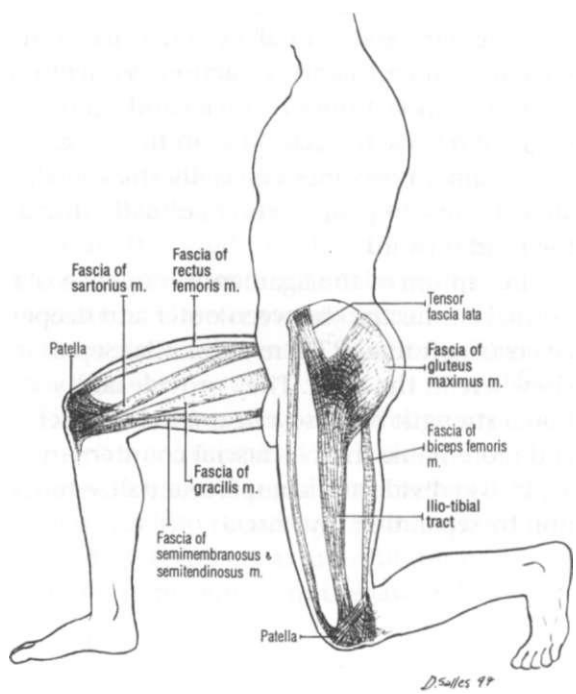


Figure 19-1
The suspension of the knee from the hip.

attachment below the knee. It is functionally shortened when its underside is stuck to the greater trochanter of the femur. When this happens, its extreme rigidity is a measure of the stress on the muscle.

The sartorius is attached on the tip of the anterior superior iliac spine, immediately adjacent to the attachment of the tensor fascia lata. It diagonally crosses the thigh in an S shape, attaching to the tibia below the knee, on the inside of the leg.

Just deep to the sartorius, the rectus femoris attaches on the anterior inferior iliac spine. It descends the front of the leg in a straight line, blending into the upper part of the patellar tendon above the knee. The tendon continues across the front of the knee to the front of the tibia. The patella (kneecap) sits within the tendon like a bony cushion

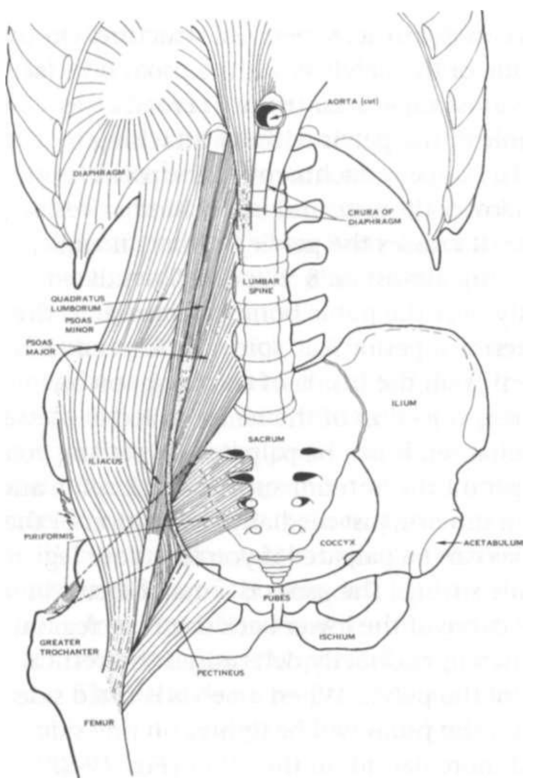


Figure 19-2
The psoas connects the lumbar spine (deep) with the lesser trochanter of the femur (superficial).

on the front of the knee, like a pebble in a stream. The patella itself is not a stationary, weight-bearing bone. It is a modification of the connective tissue within the patellar ligament (a sesamoid bone).

On the inside of the legs, the adductors are the primary component of the V shape of the inner thigh. The gracilis is the only adductor that crosses both the knee joint and the hip joint. It is thus classified as a superficial leg muscle. The other, deeper adductors cross only the hip joint; they do not extend below the knee. The gracilis is a broad band of muscle that, with its fascia, is attached on the pubic ramus. It continues to the knee, coming to lie underneath the sartorius and attaching to the medial projection of the tibia below the knee joint.

On the back of the leg are the hamstrings. Three of these muscles extend from the sitting bone (ischial tuberosity), which is a bony projection of the hip bone in back and below. Two hamstrings continue to the inside (medial) side of the knee; the third attaches laterally below the knee joint.

The combined action of the long superficial muscles affects both the knee and the hip joints. Like the shoulder, the knee is a suspended structure. On its lateral side, position and function are determined by the gluteus maximus, the tensor fascia lata, and the lateral hamstring (biceps femoris). On the medial side of the knee, there is the interaction of the sartorius, gracilis, and the two hamstrings (semitendinosus and semimembranosus).

Medially and laterally, this superficial suspension of the knee resembles two inverted tripods. Medially, the suspensions are from the anterior superior iliac spine, pubic ramus, and ischial tuberosity. Laterally, they are the ischial tuberosity, the sacroiliac joint, and the lateral side of the anterior superior iliac spine.

It is our professional experience that knee problems originate in the knee only when

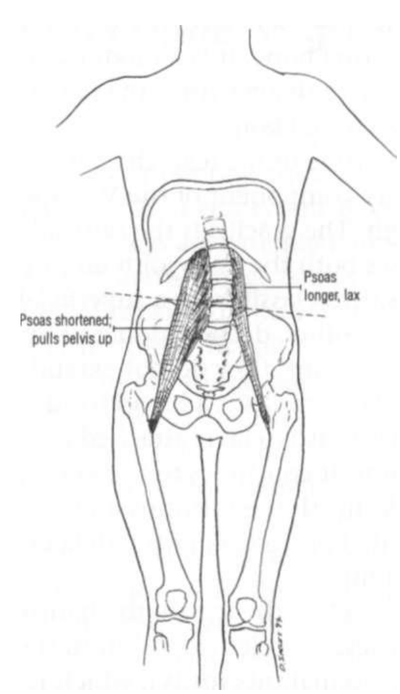


Figure 19-3
The tilt of the pelvis changes/is changed by the tone of the psoas.

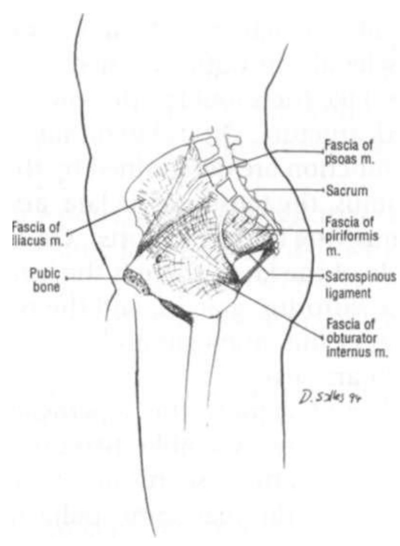


Figure 19-4
Psoas and iliacus fasciae come together at the groin, forming the iliopsoas tendon. The iliacus fascia is continuous with the deep pelvic fascia, e.g. the obturator internus.

there has been direct trauma to the knee. A knee that tracks straight forward implies that its attached muscles are in equal tension. Unequal tension in the knee muscles originates in the hip, which then modifies the tracking of the knee. Over time, using a knee in a deviated position will result in a "knee injury" which has originated in the pelvis. This analysis of knee injuries is borne out by many bodyworkers, who report best results ameliorating the knee problems of dancers or runners when working with the hip.

A big surprise in our classification of muscles as superficial or deep comes when we consider the psoas ***(Fig. 19-2).*** This was Ida Rolf's favorite muscle; one might term it the Rolfer's muscle. It lies on the inside of the body and attaches inferiorly deep within the leg. It is nevertheless a muscle that crosses more than two joints, and we therefore define it as an extrinsic, superficial structure. On the inside of the pelvic bowl, the psoas is in fact the most superficial tissue. It crosses the whole of the pelvis without attaching to it.

The upper attachment of the psoas is on the lower thoracic and upper lumbar vertebrae. It crosses the pelvic bowl at an angle, forming almost an S shape. It flows diagonally over the pubic bone just medial to the anterior superior iliac spine. Its lower attachment is on the inside of the thigh, on an inner projection of the femur called the lesser trochanter. It can be palpated by placing your finger on the anterior superior iliac spine and then moving just medially. The action of the psoas can be palpated if you kick your leg while sitting. The psoas is a major factor in the curve of the lower back (lumbar) region. It thereby indirectly determines the vertical tilt of the pelvis. When a pelvis is tilted sideways, the psoas will be tighter on one side and more flaccid on the other ***(Fig. 19-3).***

The deeper layer of muscles in the hip affects only the hip joint. These muscles balance and stabilize the leg as one moves through them sequentially in walking. In a general way, these deeper muscles form almost a circle of muscle and fascia around the upper part of the femur. Their range of movement is small but their shortness gives them a great mechanical advantage. The extent of their effect is great because of their fascial connections up into the trunk and down into the leg. Trouble comes when the superficial and deep muscle layers are glued together.

The iliacus muscle lies deep to the psoas inside the pelvis *(Fig. 19-4).* It lines the inner pelvic bowl. It attaches along the entire inner curve of the ilium, just below the crest. In some people, the attachment extends medially to the inner side of the sacrum and is thus often a factor when there are sacroiliac problems. The muscle continues down across the pubic bone in a funnel shape, crossing the hip bone next to the psoas. The iliacus follows the path of the psoas to the lesser trochanter and often joins with it to form a common tendon. The iliacus lines the entire inner surface of the pelvic bowl. A habitual contraction in this muscle creates a feeling of spasm on the inside of the pelvis. Both iliacus and psoas are involved in the placement of the pelvis and lumbar spine.

The term "lower back" includes the lumbar spine, the sacrum, and the two ilia. The iliacus is a major inner determinant of the placement of the ilium; the psoas is a major inner determinant of the placement of the lumbar spine. When the psoas is glued down onto the iliacus, independent movement of these bones, as well as of the muscles, is lost. There is not a free flow of movement through the lower back vertebrae, the pelvic bowl, or the femur. The delicate rocking movement within the pelvis that is essential for a fluid stride is lacking.

On the inside of the thigh, three adductor muscles attach to the pubic ramus and the front of the pubic bone *(Fig. 19-5).* They continue down to the upper part of the inside of the femur. Of these, the adductor longus is most commonly overused. It can be felt as a heavy cord just to the side of the genitals. Its tightness is unrelenting; it almost never relaxes.

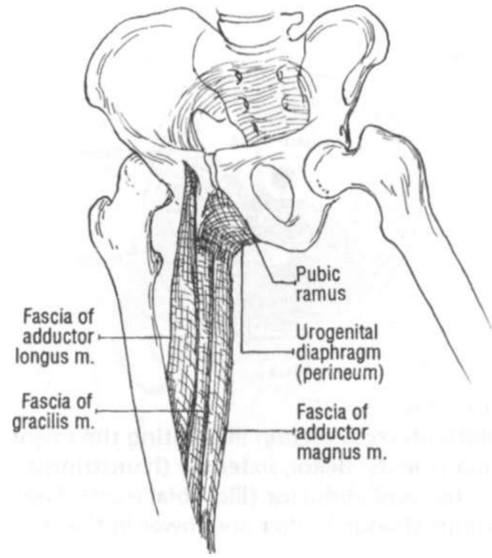


Figure 19-5
The fascia of the adductor group (longus, gracilis, magnus) is continuous up into the pelvic bowl and influences the urogenital and pelvic diaphragms. Tension is transmitted from inner thigh to pelvis and/or vice versa.

The adductor longus attaches to the inside upper third of the femur, just below the attachments of the iliacus and the psoas. The pectineus, another adductor, lies between the adductor longus and the psoas. It can be felt on palpation of the groin region, in a depression between the two longer muscles. It is a short, flat, often fairly flaccid muscle designed to draw the leg more toward the center.

The largest of the adductors is the adductor magnus. It arises as a large mass from the whole length of the pubic ramus. It fills the space deep to the gracilis and ends by wrapping around the back of the femur, behind and deep to the hamstrings *(Fig. 19-6).* The adductor magnus is the basis for the characteristic shape that is often seen on the inner

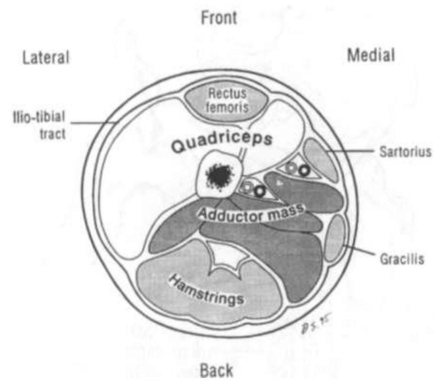


Figure 19-6
A midthigh cross section illustrating the major compartments: flexor, extensor (hamstrings), adductor, and abductor (ilio-tibial tract). The relationships change higher and lower in the thigh.

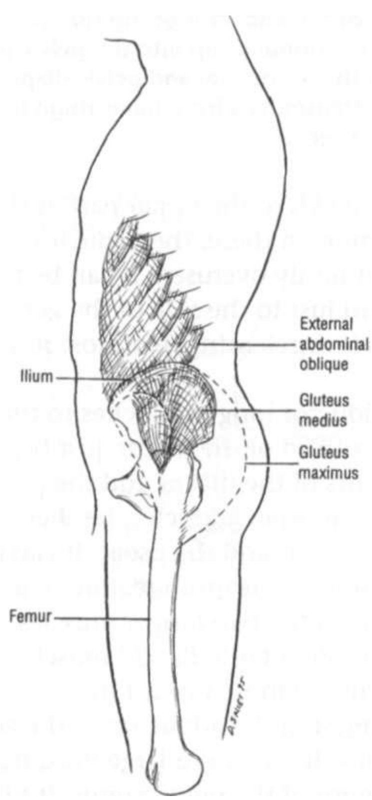


Figure 19-7
The gluteus medius is influenced by the gluteus maximus, which overlaps it. The fascia of the gluteus medius is continuous with that of the abdominal obliques at the iliac crest. This is the structural basis for the more tenacious "love handles."

side of the thigh. Like the pectineus, it is usually underdeveloped and underused. When the knee is rotated out of true, the gracilis takes over the function of the adductor magnus. The deeper muscle then cannot achieve its true tone and function. In addition, when the hamstrings are stuck to the adductor magnus, the usual result will be spasms or cramps in the hamstrings that no amount of stretching can relieve.

At the intermediate level, there is a fan-shaped muscle called the gluteus medius on the side of the pelvis ***(Fig. 19-7).*** Its upper attachment is on the crest of the ilium. It funnels downward and attaches on the top of the greater trochanter of the femur. It is partially covered by the upper margin of the gluteus maximus. When the upper border of the gluteus maximus is stuck to the gluteus medius, the head of the femur is pushed into the hip socket, impeding the free swing of the leg. A hallmark of this kind of holding or shortening is the thickened tissue on the side of the hips, on the crest of the ilium.

Underlying the gluteus maximus and medius there is a group of seven muscles, six of which are classified as lateral rotators of the leg ***(Fig. 19-8).*** The term "lateral rotation" is an anatomist's term, yet a move of purely lateral rotation is almost never made.These muscles serve more functions than purely lateral rotation of the leg. All seven muscles attach like a fan to the back part of the greater trochanter of the femur. We will discuss only some of them in detail.

The lowest of the lateral rotators is the quadratus femoris. It attaches on the lower margin of the greater trochanter and continues to the pelvic ischial tuberosities. It forms a part of the fold or crease of the buttocks, underlying the posterior portion of the groin band. When the quadratus femoris and its fascial covering are tight, this is visible as a marked dimpling below the pelvis, which accompanies a "flat ass."

Another lateral rotator, the obturator internus, lies headward of the quadratus femoris *(Fig. 19-9).* Its external part is a tendon that attaches on the greater trochanter and crosses the back part of the pelvic bone, midway between the ischial tuberosity and the tailbone. The muscle itself fills the lower inside bowl of the pelvis, attaching around the circular opening called the obturator foramen. The muscle body is on the inside of the pelvis; its tendon attaches on the outside of the hip. Through its connection with the inner tissue of the pelvis, the obturator internus is very likely to be connected with menstrual or premenstrual tension and cramps in women. A very tight obturator internus in men tends to show as an extreme narrowness of the pelvis at the bottom, with a corresponding winging-out of the upper margin of the pelvis.

The piriformis, also a lateral rotator, attaches to the back part of the greater trochanter, slightly above the obturator internus. It angles headward to attach to the underside of the sacrum. The piriformis crosses into the pelvis through the greater sciatic foramen, along with the large sciatic nerve. When this muscle is cramped or chronically tensed, it frequently gives rise to the pain that is called sciatica.

The gluteus minimus is not included as a lateral rotator in classical anatomy. To us, this fan-shaped muscle completes the larger fan of the lateral rotator group. It lies deep to the gluteus medius and attaches on the outside of the ilium to the upper part of the greater trochanter.

Tightness in the lateral rotators as a group provides the dimple in the back of the buttocks that looks so cute to some people. Actually, bodies with that dimple tend to walk with a waddle, with feet and legs splayed sideways. An attempt to correct the situation by forcing the feet to point straight forward is not successful because the problem arises in

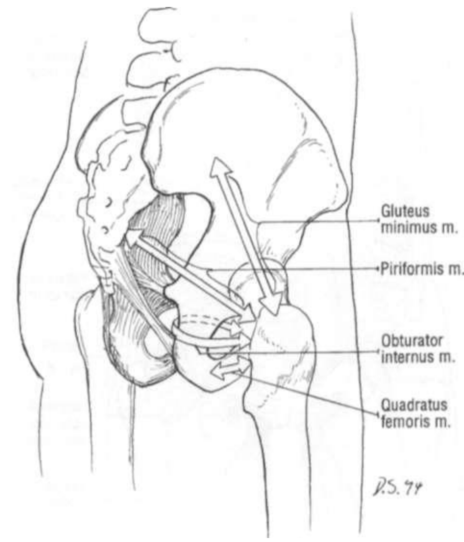


Figure 19-8
The rotators of the hip include the piriformis, quadratus femoris, internal and external obturators, and the superior and inferior gemelli. For clarity we have omitted the lines of force of the minute gemelli; the obturator externus is not visible from this angle. We are including the lines of force of the gluteus minimus to complete the picture of this fascial layer.

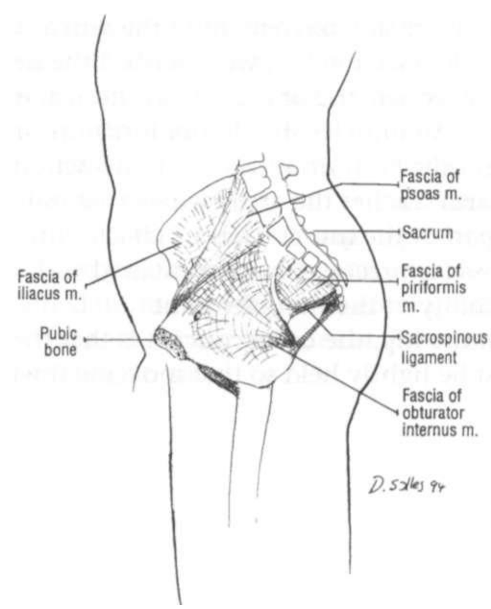


Figure 19-9
Note the relation of the fascia of the obturator internus to the deep pelvic fascia.

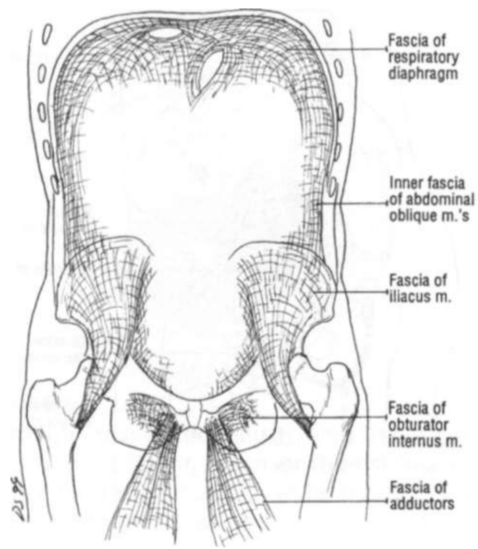


Figure 19-10
Fascial continuity: adductors -> obturator internus -> iliacus -> internal abdominal obliques -> diaphragm.

the tightness of tissue in the hip. When the hip is tightly bound, forcing the feet to track straight forward puts a torque into the leg that peaks at the knee.

In discussing movement of the arm at the shoulder (Section 17), we described the necessary sequencing of muscles as the arm is raised. All muscles should not function simultaneously. Each must be called into action as the arm reaches the angle where that muscle (or part of the muscle) has its effect. This allows for precise control combined with flexibility in the shoulder joint.

In the hip, the usual concept is that the leg must be tightly held so that movement will be stable. In actuality, sequencing of muscle use is necessary for stability in the leg as well as the shoulder. As one muscle or group of muscles is called into action to induce movement of the leg, the opposing muscle or muscle group should relax and lengthen. Muscles are held in readiness (tonus) and can then contract or lengthen as needed.

It is difficult for most of us to allow the leg to move independently in its pelvic socket. Ideally, we should be able to swing the leg in the hip joint while the pelvis rocks. You can test this by standing sideways on a stair with one leg and allowing the other leg to swing over the lower stair. Usually the leg can move only as a unit with the whole side of the hip. In walking, this fascial tightness in the hip results in a gait that is initiated in the lower back, bypassing the hip joint—a strutting gait.

The shape on the inside of the pelvic bowl (pelvis and sacrum) is like two bowls, a larger bowl on top of a smaller one. The upper, greater bowl, which is the inner surface of the ilium, is lined by the iliacus muscle and its fascia. The lower, smaller bowl is lined on its sides by the obturator internus and its fascia. Since the two bowls are continuous, it is easy to visualize the fascial continuity between the obturator internus and the iliacus *(Fig. 19-10).*

About halfway down the lower bowl, a sling-like arrangement of muscle and fascia divides it into upper and lower parts. This is the pelvic floor, also called the pelvic diaphragm. Above this diaphragm lies the bladder, rectum, and in women the uterus and ovaries. The margins of the pelvic diaphragm are continuous with the obturator internus fascia. *(Fig. 19-11).*

The pelvic diaphragm is composed of four muscles. The pubococcygeus is the largest of these. It connects the back of the pubic bone, behind the pubic symphysis, to the inside of the second or third segment of the coccyx. Fanning out from this muscle are the ilio-coccygeus, the ischiococcygeus, and the coc-cygeus. Collectively, these are often referred to anatomically as the levator ani. We refer to them in this text as the pelvic diaphragm.

Blended into the muscles of the pelvic diaphragm are the sphincter muscles of the anus, bladder, and in women the vagina. There is a mutual balance between these sphincter muscles and the sling muscles of the pelvic floor mentioned above. The tone of one is reciprocally determined by the tone of the other. When the lumbar spine is angled too sharply forward or backward, the tilt of the pelvis will follow suit. The soft tissue of the pelvic diaphragm will show the stress. The tone of this diaphragm is a major factor in healthy reproductive and elimination systems.

Below the pelvic diaphragm, filling the space horizontally between the V-shaped bones of the pubic rami, is the urogenital diaphragm, also known as the perineum. In males it contains the perineal muscles, including the muscles at the base of the penis. This area is often compressed by clenching the muscles of the buttocks, which has an effect on the function of the penis. In

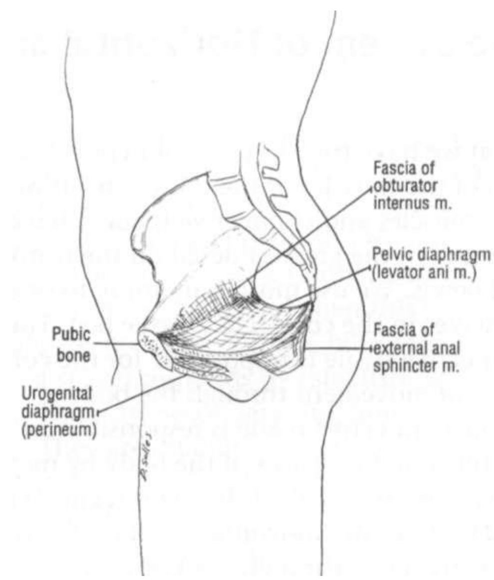


Figure 19-11
The margins of the pelvic diaphragm are conti-nous with the obturator internus fascia.

females, the perineum is bisected by the opening to the vagina. The labia majora are frequently almost glued to the bones of the rami. This means that the opening to the vagina is relatively rigid and lacks the resilience and flexibility that is important for sex and childbirth.

The area between the ischial tuberosities and the tailbone is referred to as the ischio-rectal fossa. The urogenital diaphragm does not extend this far back. The only muscle contained in this area is the external sphinc-ter of the anus. The remainder of the area is filled with a fat pad.

TWENTY
The System of Horizontal and Vertical Myofascial Structures

What we have tried to do in our consideration of the muscles of the body is to show how muscles and connective tissue interact, focusing in the greatest detail on the trunk and pelvis. We use muscle anatomy to orient ourselves in the connective tissue bed. The connective tissue is responsible for the continuity of movement through the body.

The connective tissue is responsible for establishing the spaces of the body by means of what we have called the diaphragms ***(Fig. 20-1).*** These are horizontal myofascial structures that cross through the body. The lowermost two of these diaphragms are in the pelvis. The urogenital diaphragm is below, with the pelvic diaphragm slightly above it. There is the respiratory diaphragm in the trunk separating the abdominal cavity from the chest cavity. We have also mentioned the scalene muscles at the base of the neck as acting like a diaphragm affecting the top of the lungs.

In addition to this system of horizontal myofascial structures, we have described a vertical (core) system through the body in earlier sections ***(Fig. 20-2).*** This vertical continuum includes the interosseous membrane of the legs, the deep fascia of the thigh, the internal fascial lining of the bowl of the pelvis, and the mediastinum. It continues by way of the fascia around the cervical viscera (esophagus and trachea) to the back of the mouth and pharynx, and ends as the fascial septum that lies between the two halves of the brain.

Acute tensions are communicated through the body by way of these horizontal and vertical connective tissue pathways. This results in a generalized tension through the inner aspect of the body that is characteristically

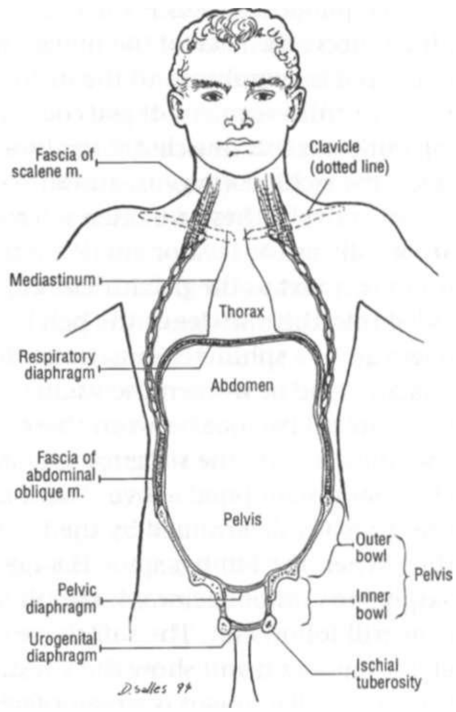


Figure 20-1
The connective tissue establishes the spaces of the body.

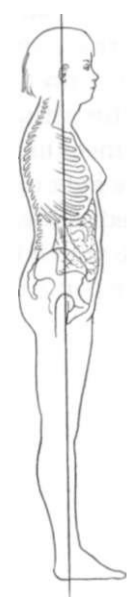


Figure 20-2
The plumb line.

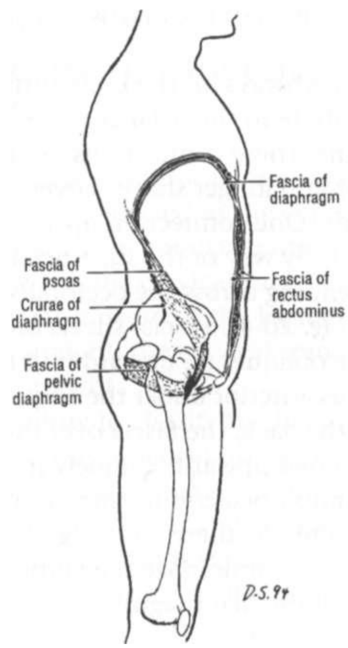


Figure 20-3
It is obvious from this diagram that changes in any part of the abdomen and pelvis will affect all of the abdomen and pelvis.

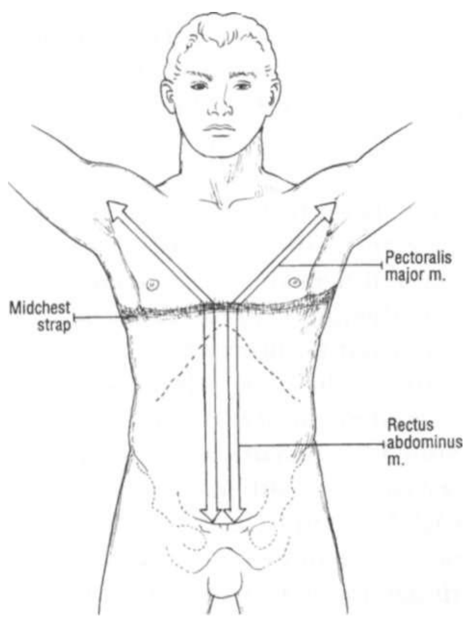


Figure 20-4
Fascial connection between pubic bone and humerus.

expressed as a kind of overall irritability. It is a feeling of "don't touch me" or "I can't cope" rather than an acutely debilitating pain.

When we refer to spaces within the body, it should be remembered that these spaces are not empty. They are filled with organs, connective tissue, muscles, etc. The vertical and horizontal myofascial pathways we have described above exist as a normal part of the structure of the body. When this is out of balance, connective tissue filling the intervening spaces responds by establishing stress lines. These are secondary functional structures. They are established in response to need and may be resorbed as function is modified.

For example, there are connections from the respiratory diaphragm down into the pelvis. Where the abdominal diaphragm lies adjacent to the vertebral column, it sends extensions (crurae) down as far as the upper part of the sacrum ***(Fig. 20-3).*** Just lateral to each side of the vertebral column, the psoas penetrates these crurae and extends up to attach to the lower vertebrae in the chest cavity. In this way, the fascia of the psoas is continuous with the fascia of the lower border of the diaphragm. The fascia of the psoas via the iliacus is also continuous with that of the obturator internus, which then blends into the diaphragms in the pelvis. In the back, the connective tissue of the psoas is continuous with that of the quadratus lumborum and the erector spinae.

On the sides, the respiratory diaphragm blends into the transverse and oblique abdominal muscles. In the front, the diaphragm is continuous with the fascia on the underside of the rectus abdominis. The rectus abdominis provides a connection between the front of the respiratory diaphragm and the pubic bone. The abdominal obliques are a continuation of the respiratory diaphragm down to the crest of the ilium, continuing into the pelvic diaphragms by

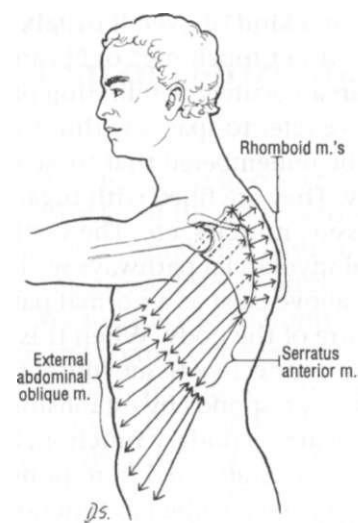


Figure 20-5
Fascial connection from front of abdomen to upper back.

way of the fascia of the iliacus and obturator internus.

Fascial pathways on the body surface also contribute to the balance among the diaphragms. These connections tend to be in broader and longer sheets, covering more of the body. One connection up across the abdomen is by way of the superficial abdominals, extending across the pectoralis major to the arm ***(Fig. 20-4).*** Fascial sheets on the surface of the obliques tie upward into those on the serratus anterior under the scapula ***(Fig. 20-5).*** In the back, the fascia over the gluteus maximus flows upward obliquely into that of the latissimus dorsi connecting on up into the arm. The often leathery covering of the erector spinae can immobilize the vertical play of any or all of the diaphragms.

TWENTY-ONE

Reciprocity of Movement

Spinal curves are reciprocal. The curve of the lumbar spine is reflected in the curve of the cervical spine. If the lumbar spine is curved too far forward, the cervical spine will also be curved too far forward. If the lumbar spine is too flat or straight, the cervical spine will be too flat or straight.

It is tempting to classify the balance of the spine by the way a person holds himself when he is standing still. In actuality, the spine is like a spring, expanding and contracting as the person moves and breathes. The true diagnosis of the spine is not in its curvature but in its quality of movement. No part of a moving spine should be quiet or still. If one segment of the vertebral column is being held still, freedom of movement throughout the spine will be inhibited.

When we talk about movement, we usually think of large gestures like walking, doing work, picking up the baby, washing the dishes, driving the car. Yet movement can be as subtle as slow breathing during sleep. A body never stops moving. Even the smallest movement creates a ripple throughout the entire organism. The tissue through which this ripple is transmitted is the connective tissue. When connective tissue is in tone, it is much like the catgut on a properly strung cello. It transmits vibrations; it transmits movement. So maybe we should say that when we are properly in tone, we hum—to each person his or her characteristic tone.

We can demonstrate this for ourselves by two awareness exercises. Sit or stand, letting your head and arms be very loose, and sense your breathing. Be aware of your breathing with your body relaxed as much as possible. If you then hold your head still (like starting to think about something), you will sense a restriction in your breathing. Notice that when the head is held very still, the breath is both shallower and more labored. If you once again let your head be very easy, along with the rest of your body, you can feel a greater ease in breathing. There is more fullness of breath with less effort.

Another example of this can be seen in walking. Allow your head and shoulders to be as limber and loose as possible. If you can even let them flop a bit, this will give you an exaggeration. Then, while still walking, hold your head still. Concentrate on a thought, and register how this holding results in rigidity in the whole back. You will notice an increased heaviness on your heels as you walk. After walking in this more stressful position, again let your head go easy, nodding gently yes (or no, if that's your attitude). Feel how your back lengthens and moves with greater ease. Your step will become much softer.

These are two examples of how holding one part of the body affects the rest of the body. They are deliberate gestures. We all have holding patterns in our bodies that are involuntary. Whether the holding is of a single muscle or of a larger part, the whole body will be affected. When you hit the side of a table, the resonance of the blow vibrates through the entire table. Similarly, any gesture vibrates throughout a living body. We tend to forget that we are a single vibrational unit. Holding one part still constitutes an interference with our resonance.

There is a toy called a Slinky™, a highly tempered, very long spring coil of steel. One of the things that a Slinky will do is pull itself downstairs. If you start by pulling one end of the coil down one step, each circle in the coil will pull the next one after it. This is an example of movement reverberating through a structure. Although it is not made of steel, the elasticity and organization of the connective tissue reverberates like a Slinky in the body.

This kind of reciprocity of movement is especially apparent in the spine. Because the superficial muscles are the longest, holding patterns at a superficial level affect a broad expanse of the back. Holding at deeper levels affects smaller segments. Usually, holding in an area occurs at more than one level, and to a different degree at each level. Sideways curvatures of the back, as in scoliosis, are accompanied by stepwise compression of the soft tissue of the back, alternating from one side to the other of the vertebral column.

The erector spinae are covered by a heavy fascial sheet, the lumbo-dorsal fascia, which blends into the heavy connective tissue pad on the sacrum and coccyx. From the sacrum, the fascia continues diagonally across the buttocks and on into the ilio-tibial band ***(Fig. 21-1)*** Thus, both clenching the buttocks or holding the legs have a clear effect on the back all the way up to the head. Conversely, problems in the back are generalized to the buttocks and legs as well as to the head.

Through its connection with the fascia of the latissimus dorsi, the lumbo-dorsal fascia

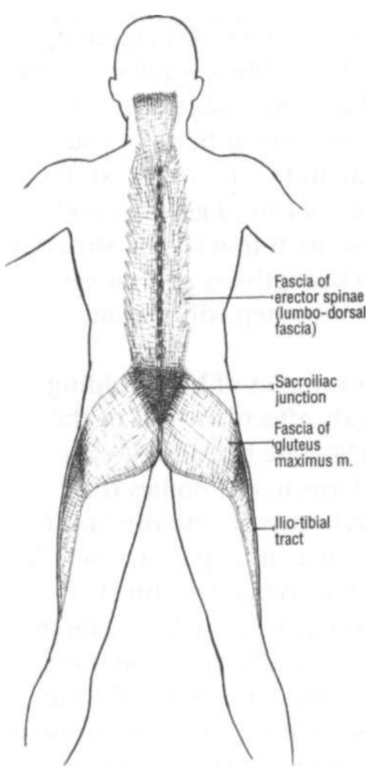


Figure 21-1
The superficial fascia of the back is layered. It starts with the continuity of the whole back with the leg. The change in direction converges on the sacrum.

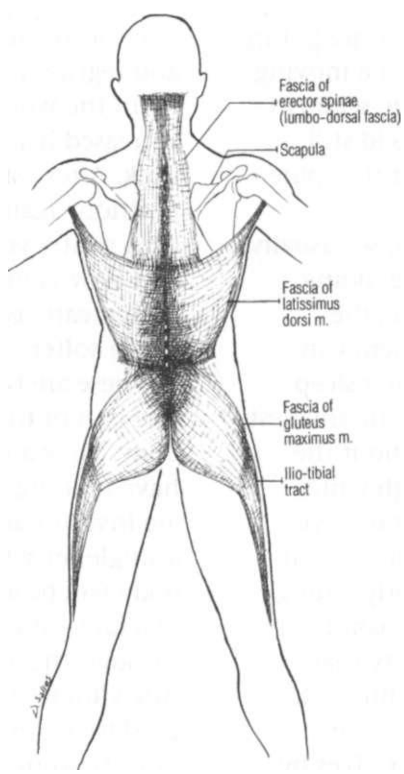


Figure 21-2
As we include the fascia of the latissimus dorsi, the change in directional pull converges over a wider area.

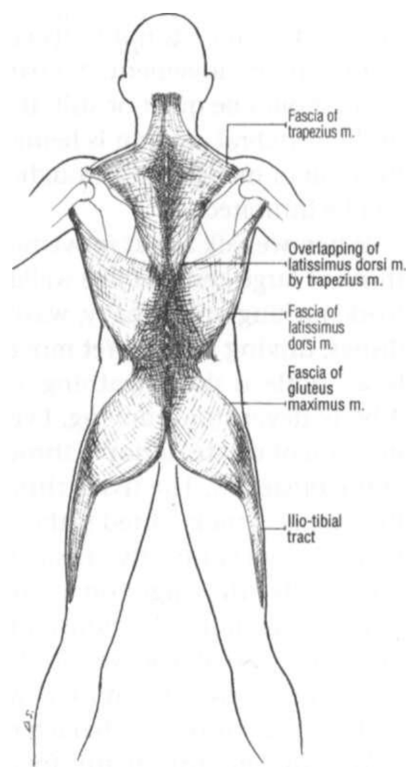


Figure 21-3
Still at a superficial level, the fascia of the trapezius adds yet another dimension.

mediates a reciprocal effect on the freedom of the shoulder and arm *(Fig. 21-2).* The fascial crossover point between the trapezius and the latissimus dorsi (the dorsal hinge) is at about the sixth and eighth thoracic vertebrae *(Fig. 21-3).* Holding patterns or pain in the arms (such as from a tennis elbow) are felt as a spinal restriction in this area. In short, the fascial covering of the back is continuous with all other parts of the body. The broad fascial connections on the surface of the body allow restrictions to be generalized over the whole structure. This can give short-term relief in acute trauma, but ultimately such restriction becomes chronic and difficult to track down and release.

On the inside of the spine are the deep flexors of the trunk. In the lumbar region, there is the psoas, which attaches to most of the lumbar vertebrae. The quadratus lumborum is a short muscle that lies between the psoas and the erector spinae *(Fig. 21-4).* This muscle is defined as connecting the twelfth rib (the lowest, shortest free rib) to the upper margin (crest) of the ilium. The quadratus lumborum is the connection between the inside and outside of the body at the waist. The fascial sheets of the erector spinae, quadratus lumborum, and psoas are continuous *(Fig. 21-5).* This fascial blending travels laterally to form the connective tissue covering of the abdominal oblique muscles and the rectus abdominis. Distortion in any one will distort all to some degree.

In the lumbar region, movements are obviously not straight forward or straight backward. The most frequent movements of the lower back—walking, leaning over, reaching—all include twisting or spiraling. What is desirable is a balance of the twisting on the two sides. Most of us have a slight rotation to one side somewhere in the mid-trunk. Standing relatively still, one hip and leg habitually stand slightly forward of the other, while the shoulders and arms are reversed in rotation

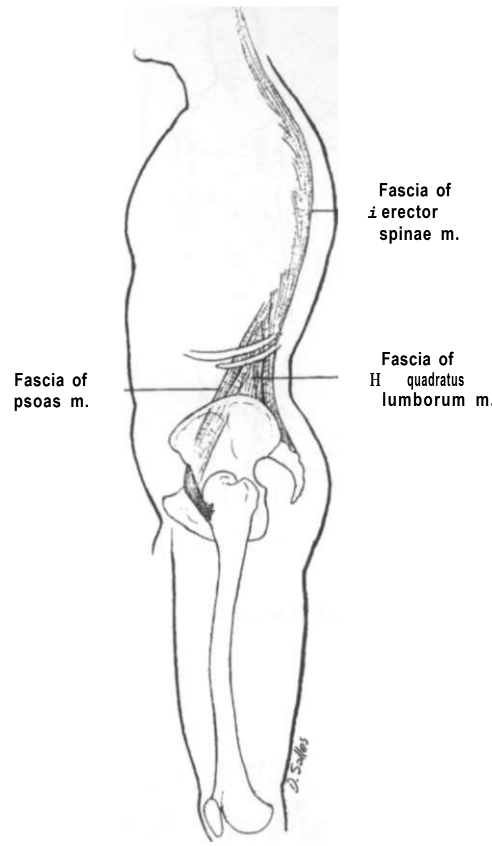


Figure 21-4
The deep muscles of the lumbar region.

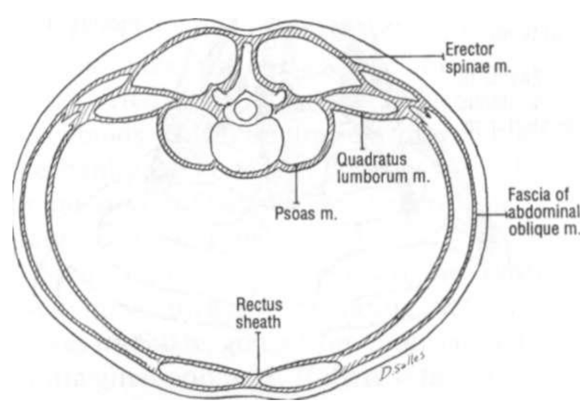


Figure 21-5
This diagrammatic cross section of the abdomen is in the region of the lumbar spine. The continuity of the fascia as it ensheathes the muscles and the vertebra is emphasized.

Figure 21-6
Habitual rotation of the body.

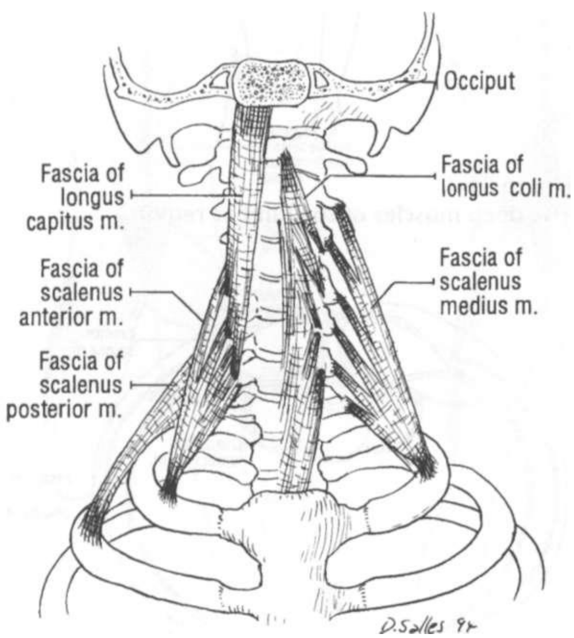


Figure 21-7
For clarity, we have depicted the deep muscles of the neck separated on the two sides. The composite of the two sides make up the total myofascial complement.

(Fig. 21-6). The bottom half of the body goes in one direction, while the top half goes in the other. In walking, the leg and hip that are slightly forward have less distance to travel and therefore tend to move more straight forward. The opposing leg and hip, which are slightly behind, have to work harder and traverse a greater distance. Usually this side moves diagonally and with a swing. The difference is perhaps a half an inch or less. Over years of constant use, the side that works harder will show the strain in the back. One side will shorten, giving the impression of a shorter leg and a slight limp. Very slight differences in distance in the body create large effects.

The peak of torsion in overall body spirals will be most apparent at the waist, which thickens and shortens. Most people have no functional waistline and therefore few people have a concept of it. The waistline becomes apparent when the body unrotates and the lower free ribs literally lift off the pelvis. Muscles and fascia on the inside and outside of the vertebral column hold the lower ribs down into the tissue accumulation on the brim of the pelvis. As the lower back unrotates and lengthens, a waistline may miraculously appear. This can result in ecstasy and a new wardrobe for women. Men may experience consternation if they believe the pelvis is not supposed to exist except as a small pathway between the large chest and large thighs. Nevertheless, they too will have a more amiable relationship with their tailor.

The upward continuation of the erector spinae into the neck blends with the pad at the back of the head. The largely vertical action of these muscles is modified by a lateral pull from the more superficial trapezius. The flexors on the front of the neck balance the erector spinae in back, which are extensors of the neck. At the deepest level are two pairs of muscles that lie directly in front of the transverse processes of the cervical vertebrae. The upper pair (longus capitis) connect the cervical vertebrae to the base of the skull in front of the spinal column. These flex the head on the top cervical vertebrae. The second set (longus colli) extends down from the transverse processes of the cervical vertebrae to the transverse processes of the upper chest (thoracic) vertebrae. These muscles flex the neck on the trunk *(Fig. 21-7).*

At a slightly more superficial level, fanning out to the side, there are the scalene muscles. These attach to the transverse processes of the cervical vertebrae and continue on to the surface of the first and second ribs. These are active in both flexing the neck and turning the neck from side to side. At the most superficial level, on the front of the neck, are the sternocleidomastoid muscles *(Fig. 21-8).* These large muscles move the head with respect to the neck as well as moving the neck vertebrae on the trunk. The fascial wrapping of all these muscles is continuous. In the neck, fascial gluing can occur between flexors and extensors as well as between layers, creating problems in the freedom of movement of the neck and head.

The ideal myofascial blueprint is thrown out of kilter when the head is thrust too far forward. When this is the case, most head movements must be controlled by the sternocleidomastoid. The erector spinae and the trapezius are then used almost exclusively to hold the head on. Their function as extensors in balance with the flexors on the front of the neck is reduced. When the head is too far forward, these flexors on the front of the neck (longus colli and longus capitis) lack the span to function properly. The sternocleidomastoid then becomes both the chief flexor and extensor of the neck. This is an awkward situation and one that leads to very restricted movement of the head.

In the chest region, prevertebral muscles

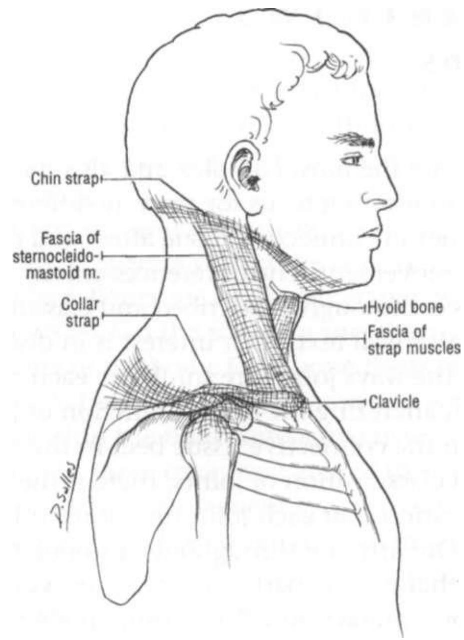


Figure 21-8
Superficial fascia of the neck.

are not very apparent. It was Ida Rolf's conviction that spinal balance relies chiefly on stabilizing the concave curves of the spine. The psoas stabilizes the concave inner surface of the lumbar spine; the longus colli and longus capitis together stabilize the concave inner surface of the neck portion of the spine. In Dr. Rolf's view, the dorsal curve of the spine is supported along its outside surface by the rhomboids. This is an unusual view of body mechanics, and one that depends for its logic on questions of balance, movement, and transmission of weight.

Spinal curves are always changing. With every move, including breathing, these curves undulate, going from more curved to straighter and back. If there is fluidity of movement through all parts of the vertebral column, the rest of the body will readily arrange itself into appropriate balance for the person, time, and gesture.

T W E N T Y - T W O

Joints

Joints are the most complex and also the most interesting focus for the way different densities in connective tissue affect and determine movement. The differences among joints is thoroughly described and classified in anatomical texts. Our interest is in discovering the ways joints are similar to each other and in analyzing the overall function of joints within the connective tissue bed. In the traditional classification of joints, there is the implication that each joint functions in isolation. Our attitude throughout this book has been that no one part of the body moves without interaction with all other body parts.

The elements of a joint are:

- Two or more bones;
- The relatively nonresilient tendons and ligaments;
- The fluid-filled joint capsule;
- The more resilient muscular and connective tissue combination known as myofascia.

At the deepest level, by means of the fibrous joint capsule, the periosteum of one bone is continuous with the periosteum of the next bone. Within the joint capsule, bathing the ends of the bones, is joint fluid. It is very similar in composition to the intercellular matrix of all connective tissue. This description applies to all joints that are traditionally classified as freely movable. Our feeling is that it also applies to those joints classified as slightly movable or immovable. They differ only in the proportion of fluid within the joint capsule. A normal joint comprises adjacent bones, which literally float with respect to one another. If the ends of the bones are drawn too close to each other, irritation of some kind will result. Conversely, when a joint is distended with too much fluid (fluid on the joint), loosening the connective tissue above and below the joint results in a return to normal size. This can be accomplished without the need to touch the actual distended area.

The joint capsule is made up of fibers that have formed in the embryo in response to directional tension lines between bones. A mature joint capsule also lays stress lines to accommodate the different rotations of move ment. The result is an interweaving of fibers around the end of the bones. This encloses the fluid-filled space between the bones, and is continuous with the periosteum ***(Fig. 22-1)***

There is a tendency for connective tissue to wrap a joint as stress within the joint increasingly calls for more stability. When the joint is well-balanced and has full range

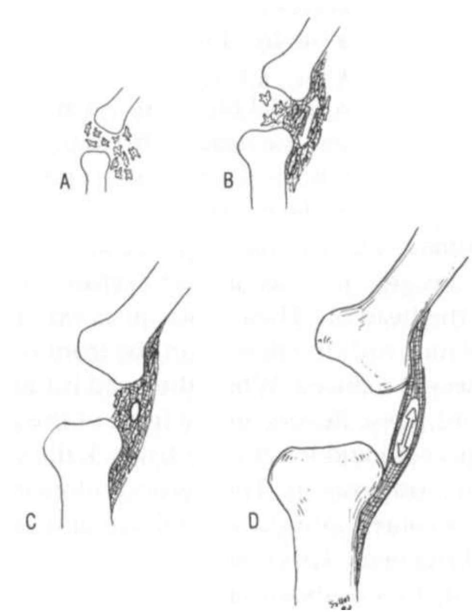


Figure 22-1
The joint capsule matures.

of movement, this wrapping will be sufficient to stabilize the joint and yet flexible enough to ease off when the joint is no longer in active use. When a joint is unbalanced or shortened, we see an accumulation of excess tissue, what we would call "bandaging." This bandaging cannot be released until we can learn to trust the stability of the joint.

An example of what we are talking about is the thickening and shortening that so frequently occurs in knees. Many knees are wrapped in such a way that they are held in a permanently bent position, unable to lengthen out. Or the knee may be held in a locked-back position. In either case, the knee is tightly bound. A well-balanced knee is one in which the joint feels very slightly bent; there is fluidity in the structure so that the knee is on "go."

Wrapping or thickening is one hallmark of what we call immaturity in a joint. The cause could be injury or lack of development or regression out of negative emotion. The physical effect in the body, in the joint, is always contraction in the connective tissue structure. Moving a joint that is tightly bound will eventually create tissue irritation. This is felt as chronic joint pain.

Immaturity in a joint is the absence of ease and full range of movement. This physical immaturity is not usually a whole-body condition. We can have a well-formed and fully functioning rib cage and sadly lacking hips and legs. This is a type that is often seen in men. The reverse is often seen in women—fully formed, voluptuous hips and a child-like top.

These have become stereotypes, symbols of what is desirable in a woman or man. A man may have a small rib cage and through the wonders of muscle-building create massive bulk on top. He can mock up the look of male maturity that is currently favored. Yet his is not a truly mature structure; he cannot fully expand his rib cage and shoulders. What he has created is simply heavy tissue padding over a contracted and narrowed structure. The padding can become very tough, even like bone. It is not possible for this to have the resilience and potential of a truly flexible structure.

Dr. Rolf realized that the bones of the body act as spacers within the connective tissue bed. Bones are hard connective tissue elements within the softer connective tissue elements of the body. Each bone floats with respect to the other. The skeleton as a whole floats within the fluid connective tissue bed. A joint is a more organized area of this structure, one where movement is expressed.

An analogy is the batten or strut in an upholstered piece of furniture. The main support for the upholstered piece is from its stuffing; the wood adds stability. The strut or batten is what keeps the couch from sagging with age. Likewise, we can consider bones as being present to prevent us from collapsing with years of use and disuse.

Underdeveloped structure is common in the foot and ankle. A baby's foot at birth is not yet functional for walking. The heel (calcaneus) is drawn up into the ankle joint. The foot projects more or less as a straight extension of the lower leg. This is a ballet dancer's dream but makes for stilted walking. Part of the structural maturation that comes with the transition from baby to child occurs in the foot. For stable walking, the heel must drop down and back. This also establishes the necessary arches of the foot.

Movement of the ankle includes both flexion and sliding. In many people, the heel remains wedged forward into the ankle joint, and sliding motion is lost. Ankle movement is then limited to flexion—the front of the foot coming up and down. This places excessive strain on the muscles of the shin. Ideally, flexion in the front of the foot is counterbalanced by a sliding motion extending the heel down. In addition, in stepping down, the joints of the foot flatten and then spring back into the arch as weight is transferred. This, too, is lost when the ankle is immature.

Immaturity of the ankles does not necessarily imply an immature individual. And yet there will be a constant awareness of lack of support. The consciousness may simply be that my feet hurt. It doesn't mean that I never feel good about anything. It does mean that even when I feel wonderful, I am also aware that my feet are bothering me.

Body types show different ways of using the connective tissue as a whole. Our favorite imaginative illustration of this is to be found in *The Wizard ofOz.* The Tin Woodsman is one common type. The outside of the body has been so toughened that the joints feel rusted. We almost must add oil to get them to work. It's as though this person has no confidence in the deeper structure; most of the support is on the surface.

At the other extreme is the example of the Scarecrow. He is soft and structureless and pliable on the surface. This is what Ida Rolf termed a "soft body." An extreme example would be a person who is double-jointed. Yet within this structure, at the deepest level, there is a thin core that is under extreme tension. This is similar to the thin sticks that keep the scarecrow upright. These deep supports in the living body are so hard they almost seem like steel. Yet they, too, have their origin in the connective tissue sleeve between and surrounding the bones, tendons, and muscles.

Instead of a static image of bodies, we would like to offer a different concept. Bodies are never completely still. When we are quiet, the fine movements of breathing and balancing are reverberating from heel bone to skull. At a level below conscious awareness, there is the constant vibration of tissue that is in tone, ready to move.

In this sense, the body is much like a car that is not turned off. When it is not moving, it is idling. Its movement is merely a shifting into gear. We may think that in order to move we have to pull ourselves out of a deep immobility and inertia, but this is not the case. We can be aware of our constant movement and vibration. We can be aware that gesture and activity are a shift of gear. They are changes in the intensity and direction of movement, but not a change in state.

One expression of this attitude is in the old song, "I want to dance with a dolly with a hole in her stocking while her knees keep a-knocking and her toes keep a-rocking."

P A R T F I V E

Practical Applications

TWENTY-THREE

Doing Bodywork Based on the Connective Tissue Concept

As our ideas have gained clarity, we realize that the connective tissue concept can be of use in any kind of bodywork. It isn't possible to provide a "recipe" for work. What we can do in this section is open a way of thinking and an approach to tissue. Ideally this will lead the bodyworker to develop appropriate strategies for conditions as they arise.

This section is divided into several subsections: evaluation, first intervention, how to go deeper, how to touch, and how to make changes last. We have taken specific conditions as examples for the sake of demonstration.

Evaluation— Example: knee pain

Evaluation can be visual, through palpation, or by observing movement. It is not necessary to do an exhaustive evaluation but rather to find a place to start. The concepts underlying evaluation are contour, symmetry, and proportion. In practical terms, this means comparing both knees from the front, sides, and back. It also means considering the extension of the knee down to the foot and at least as far up as the hip, if not farther. It is helpful to consider the anatomy involved. The knee is composed of two bones—femur and tibia—and two outriders—the fibula and the patella. It also helpful to consider gravity/body weight. The knee is the interface between the torso/hips and the ground. The hip and the ankle can be considered upper and lower extensions of the knee.

The above are elements of practitioner evaluation. Full initial evaluation is a combination of these and the client's report. Listening to the client and asking the right questions at the outset are critical: Exactly where does it hurt; point with one finger. Does the pain radiate? Are there associated pains in other body parts? What brings the pain on? When is it most intense? What makes it better? Was there an injury? Has there been a history of repeated injury? Is the pain constant or intermittent?

From the point of view of immediate intervention, probably the most important question is, "How painful is it right now?" This will tell you when and how to intervene. It is your best barometer for assessing when it may be detrimental to do work. When acute pain is not a problem, it is probably possible to work directly on the area (see section on first intervention).

Often knee pain arises only with movement. Cautious movement is a part of evaluation. What can the knee do with comfort? What movement creates the pain? Client fear and apprehension are an inevitable part of acute pain. Ideally this can be allayed to get a clearer picture of the actual tissue problems. Reassurance that pain is not the same as damage should help. Obviously it will be necessary to be gentle and slow. Your aim is to find out what the knee can do and exactly when and where pain starts.

At this point, anatomical information is essential to good visualization of the problems involved. For clarity we are using muscle nomenclature; we are actually referring to local tensions in the connective tissue bed *(Fig. 23-1).*

The tibia is suspended by the hamstrings posteriorly and by the quadriceps anteriorly. Medially and laterally, there is the adductor group and the ilio-tibial band, respectively. The interface between the tibia and fibula can be locked down by the popliteus behind the knee. Thus this very small muscle controls the interosseus membrane between these two bones. Tibial rotation is manifest at the ankles. The degree of tension in the Achilles tendon is an index of severity of rotation between the tibia and calcaneus.

Evaluation is a sequence from visualization to movement to evaluation by touch. As we move the part, we are starting to evaluate by touch. It is almost impossible to know when evaluative touch ends and treatment touch starts. If the pain is acute, it is potentially hazardous to treat the acutely painful area directly. It should be possible to ease the pain with educated intervention above and below. Your knowledge of anatomy and your careful evaluation will tell you where to start. Sometimes it is helpful to work fairly far afield in other parts of the body—associated areas of reported pain or probable areas of dysfunction (see list in How to Make It Last section, p. 126). Before we go more extensively into first intervention, we need to add a few comments on treatment of acute knee problems. Eventually it will be possible to gently start to work on the fascial wrapping of the knee itself. A simple way to do this is to restrain

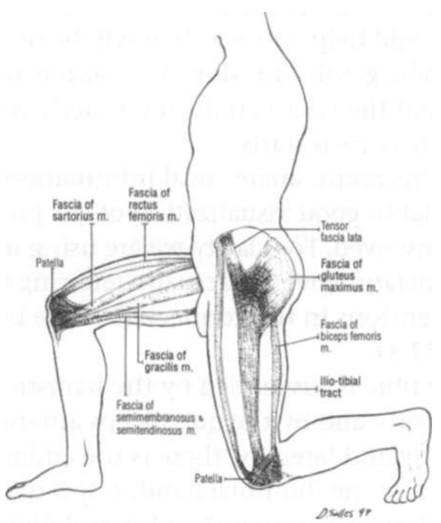


Figure 23-1
Superficial muscles of the thigh.

the knee tissue against ever-greater knee flexion and extension. This allows the client to feel safe because he/she can control the degree of movement.

It should be remembered that one cause of intermittent acute pain in the knee is a meniscal tear. This is not an absolute contraindication to work; cautious easing of the joint will be helpful. Ultimately, however, there may have to be surgery. An absolute contraindication to manipulation of the knee (except by an expert) is a tear in one of the cruciate ligaments. Such a tear may be felt as hypermobility of the knee in the anterior-posterior direction and is obvious with even slight movement. A fracture is, again, an absolute contraindication to bodywork except in the hands of an expert. If the client is able to walk into your office without crutches, it is unlikely that either of these two catastrophes has occurred.

First Intervention—Example: chronic neck ache

Some practitioners are more experienced with visual evaluation and some with palpation. Furthermore, one of the oddities of bodywork tends to be that the more experienced the practitioner, the less extensive the evaluation. In part, this is because bodyworkers continually evaluate as they work. Evaluation is not an endpoint, it is an ongoing process.

It is important to start work with the most superficial layers of tissue. Working superficially usually will allow deeper tissue problems to emerge that were not apparent at first. The client will often report that the nature or location (or both) of the pain has changed and he/she can often be more specific about the pain. This is to be expected as a normal part of practice. Early in practice, it can be confusing and humbling when this happens. Going too deep too fast will almost always create unnecessary problems and usually creates more pain.

What does it mean to work on a superficial layer of tissue? How is this done? Easily the most important maneuver is to go into tissue at an angle. Going straight in allows the tissue no escape, no movement; the tissue is trapped. Going straight in also often causes bruising. In practical terms, this means that tissue is moved in a direction, toward an intended endpoint. Once again, a knowledge of anatomy is essential.

In the neck and shoulder assembly, the most superficial muscle is the trapezius. It fans out from the occiput, the cervical vertebrae, and the upper thoracic vertebrae, across the shoulder blades to the collarbones and the acromion. The sternocleidomastoid muscle is a fairly superficial rope from the mastoid process to the sternum and the clavicle. Posteriorly and deeper, the levator scapulae suspends the shoulder blade from the cervical vertebrae. At a similar depth, the scalenes suspend the ribs from the cervical vertebrae *(Fig 23-2).*

Even this partial list of the muscles involved in chronic neck ache makes it obvious that the associated fascia is a web; the muscles are not layered like a cake, but interwoven like a mesh. A reasonable working knowledge of local anatomy gives an understanding of the tissue "layers" and direction of fascial fibers. As you work, the fiber direction under your hands will tell you what level of tissue in the body you are working on. There can be times where no dominant tissue directionality is apparent; this is common in the most superficial subcutaneous layers.

Ida Rolf was wont to say, "If the tissue doesn't move when you go in one direction, try going in the other direction." This is a rule of thumb that has stood us in good stead for many years. It should be pointed out that fascial fibers do not necessarily follow the exact path of the associated muscle fibers. Fascial fibers respond to the directional pulls exerted on them; muscle fibers are one type of pull, but there are others. For example, the fascia superficial to the trapezius has multiple fine layers in multiple directions. It is not necessary or possible to organize each of these fascial sheets. Creating order in one tends to organize sheets above and below. Direction of work may be toward a joint, away from a joint, along the plane of the muscle, or even across the muscle fibers. With attentiveness and delicacy of touch, your hands will tell you what to do. What you are hoping to achieve, the feeling you want under your hands, is the feeling of elasticity.

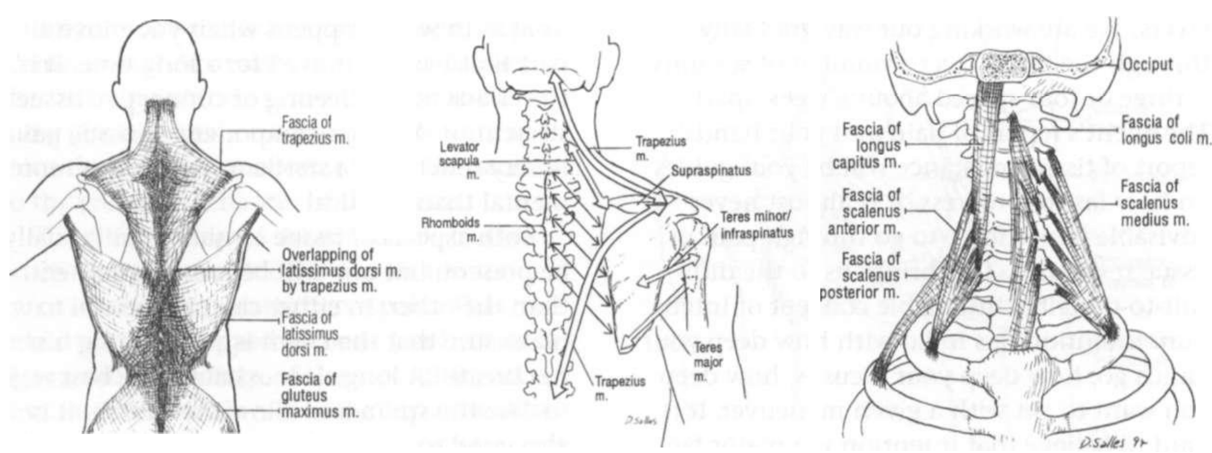


Figure 23-2
Fascial tensions in the neck and back.

The shoulder and neck assembly is one of the more complex structures in the body. One image that gives an overview is that tissue is gathered up into the neck much the way a plastic bag is gathered at its closure. In this image, any twist on one part of the neck will spread downward to the structures below. Therefore as the superficial layers of the neck are eased, tension below also starts to ease. Bones will shift their home position; muscles will shift their plane of action. This happens gradually, over time. Much happens between bodywork sessions. Changes are subtle at first; they are cumulative and soon become clearly apparent.

At some point going deeper becomes a natural extension of the work in progress. Occasionally this is a therapeutic decision, more often it is the obvious next step. One sign is that the tensions start to be more obviously associated with specific muscle action. Because the spasm in these muscles can be so severe that acute pain is elicited with light touch, it will now be necessary to ease the tissue by working further afield. In neck pain, working at the rotator cuff, the shoulder joint, the back of the ulna just above the elbow, or the margin of the occiput will bring relief.

These are not by any means the deepest layers. We are working our way gradually through the layers over a number of sessions —three or four spaced about a week apart. The client's report of pain and your hands' report of tissue resistance will be your guides on how fast to progress. It is almost never advisable to use force to go through pain or tissue resistance. This brings us to the difficult-to-describe, intangible concept of intention. Intention has to do with how deep your hands go, how deep your focus is, how deep you want to get with a given maneuver. It is hard to believe that intention is a major factor; it is even harder to believe that there is any such thing as intention.

Our struggle in this book has been to put into words what is so obviously happening under our hands. We find it impossible to give a verbal description of intention. The concept is often apparent when watching another bodyworker. It can be a useful question when the progress of work is stalled. A change in intention or goal can restore flow.

What to do when an area is touchy or ticklish? We have found that the tissue deep to a ticklish spot is invariably excessively tight. Even though ticklishness has a "don't touch" aspect to it, it is a signal that bodywork needs to be done. A light touch is generally not helpful. Easing around the area can be useful. One maneuver that can work is to make use of the body's neural wiring. Light touch and deep touch are mediated by two different sets of nerve endings. It is possible to place the whole hand firmly over the sensitive area while working more deeply with the other hand underneath the covering hand.

With deeper work there is always the potential of discomfort while working. Some clients are able to feel through this momentary discomfort to the relief that is happening. Their usual comment is that it is "good pain." There are at least two components to these sensations. There is the tissue sensation, which can be warm or hot or burning. This is akin to what happens when you move a part that has not moved for a long time. It is the characteristic feeling of connective tissue stretching. Another component of tissue pain is very much like a startle response; it is more mental than physical.

Both aspects of tissue sensation will usually be present, but one will be more prominent than the other. In either case, it is useful to make sure that the client is not holding his/her breath. A long slow exhale is the best way to ease the strain and allow the stretch. It is also good to focus attention exactly where the stretch is occurring and/or to move a related body part (wiggle the fingers). There are theoretical reasons why these maneuvers work but it's probably enough simply to know that they do work.

To finish up treatment of neck pain, the deepest structures under tension will be the levator scapulae and the layers of the cervical muscles closest to the vertebrae. The small transverse muscles at the atlanto-occipital junction can be so contracted as to be barely palpable. Working in layers to ease these is the answer. In addition, two movement maneuvers will be helpful: a small chin thrust (like a nod) and turning the head. When turning the head, the movement is initiated from the angle of the jaw just below the ear, which is a way of creating precise movement between the atlas and axis.

How to Go Deeper—Example: chronic sciatica

At the deeper level, anatomical knowledge is essential to accuracy. Sciatic pain arises from tension on the sciatic nerve, usually at its outlet, which is variably located near the middle of the sacroiliac junction. Sciatic pain is most commonly a radiating pain, extending to the thigh, leg, or foot, depending on the portion of the nerve that is impinged. Piriformis pain, on the other hand, is local to the hip, does not radiate, and can be elicited by pulling the bent knee across the body. In piriformis pain, it is usually possible to palpate the taut rope of the muscle through the overlying gluteus maximus. The piriformis runs from the inside of the lower tip of the sacrum to the greater trochanter of the femur.

The relationship of the piriformis to the sciatic nerve is variable. Piriformis tension can contribute to sciatic nerve pain. The nerve is not entrapped by bone but by the ligamentous bindings of the sacroiliac junction. As the tissue layers of the hip assembly start to release, the location of the sciatic pain and its radiation often changes. This is in fact a sign that work has been effective.

The rotators of the hip attach to the ilium, ischium, or sacrum. Although they are small, they are short and deep; they powerfully influence the basic structure of the pelvis when they are in spasm. They are a major factor in sciatic pain. They can be readily influenced by wedging the space behind the greater trochanter and asking for straight leg external rotation *(Fig. 23-3).*

The ischial tuberosity is the bottommost edge of the hip assembly; it provides an endpoint for the tendons of the hamstrings. When the hamstrings are tight, they pull downward on the ischium. As a result, the sacrum is overworked with any movement. Release must necessarily include work to release the hamstrings.

How to know where to start? Observing normal movement is usually helpful—walking, sitting, standing. One of Ida Rolf's first principles was "take the part to normal and make it move." We want to evaluate the balanced movement of the joint—the initial movement from an ideal home position. For testing purposes only, in the hip and leg, the

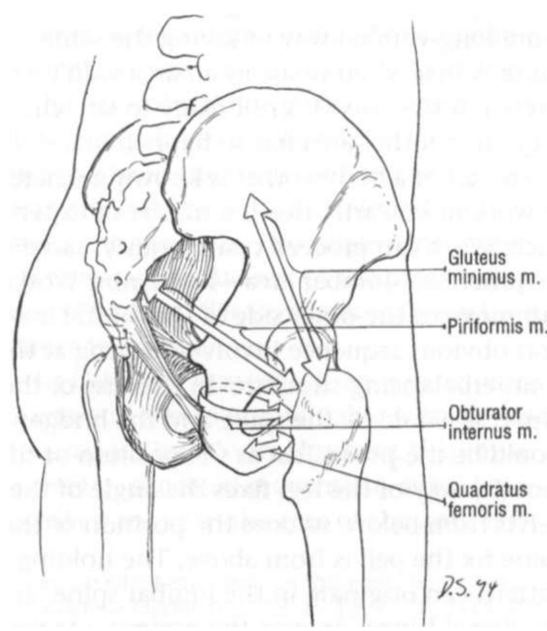


Figure 23-3
Rotators of the hip.

ideal standing position is as follows: feet together, ankles touching, heels about an inch apart. In this position, a shallow knee bend will graphically reveal tensions in the sacrum and groin. In the knee bend, the knee should come straight forward over the second toe; the back is kept straight. A second movement, leaning over to touch the toes, shows the ability of the hamstrings to lengthen and the ischial tuberosities to appropriately widen.

Three main strategies interact in this deep level of work; traction, tissue stretching, and client movement. Traction can be passive or active on the client's part. Active traction involves stretching to the limit of the gesture. For example, a heel stretch activates the Achilles tendon, the back of the knees, the hamstrings, and up into the ischial tuberosity. This can be combined with other movements, e.g. heel stretch with hip rotation or leg lift. Movements should be guided for precision to give maximum assistance to tissue stretching.

A guiding principle in soft tissue work is "what's done is done." Dr. Rolf used to say, "If at first you don't succeed, get the hell out." A more long-winded way of saying the same thing is that when tissue in an area won't stretch, it's because it's not ready to stretch. Work in another area has to happen first.

The art of a bodyworker is knowing where to work next. Partly this is a matter of experience. Work can proceed contiguously: sacroiliac junction—lumbar area—lower ribs. Work can move to the other side of the joint. One non-obvious sequence involves looking at the counterbalancing structure. In the case of the hip, this would be the spine and the bridge would be the psoas. Just as the position of the foot (by way of the leg) fixes the angle of the pelvis from below, so does the position of the spine fix the pelvis from above. The holding pattern can originate in the lumbar spine, at the dorsal hinge, or even the occiput. (As we have explained in the text, the dorsal hinge is a variable mid-back location where shoulder movement and body support intermesh.) The groin and particularly the inguinal ligament are anterior aspects of sciatic pain.

When there are true physical deficits such as a scoliosis or a missing portion of a vertebra, there will be an ongoing need for bodywork. This does not mean an office visit once a week or even once a month. It can mean a batch of work every couple of years. The client is the best judge of what he/she needs. Under stress, whether traumatic or repetitive, the body will tend to return to pattern. This does not mean that earlier bodywork was not effective. Generally speaking, renewed work will be easier, less uncomfortable, and progress will be faster.

How to Touch—
Example: carpal tunnel syndrome

In this section we are bringing together points about touch from prior sections.

(A) Consider the origin of the problem—accident, repeated injury, or repetitive use under stress. Carpal tunnel syndrome is a classic example of repetitive use under stress. A most common version arises from computer use. The gesture includes tensely staring at a small (usually too low) screen while overfocusing the eyes and thrusting the head forward. This sets up an imbalance at the shoulder—the scapula rides up, the clavicle and acromion are elevated, and the arm has lost its base of support. Even if the screen is not too low and the keyboard position is adequate, prolonged eye tension and head thrust create a problem. Tension and overuse are the culprits here. From this brief analysis it is obvious that there cannot be much help for carpal tunnel syndrome without work on the shoulder, neck, and occipital ridge.

(B) Acute spasm is a signal for caution. Work can begin on the superficial layers or on surrounding areas. The idea is to give the tissue under spasm relief before working on it directly. In acute carpal tunnel pain, it is helpful to reduce tension in the interosseus membrane of the forearm and to restore free rotation between the radius and ulna at the elbow. Almost always, there is a lock on movement of the ulna because of tissue tightness at the back of the elbow. Restoring elasticity here will start to ease the acute pain at the wrist.

(C) "Resistive movement" is our phrase for the maneuver of wedging a tissue space open while the client moves. In carpal tunnel syndrome, this is particularly useful in opening the spaces between the small bones at the base of the hand. One specific example of a small muscle that seems to get particularly tight is the opponens, which adducts the thumb across the palm. Wedging at the base of the thumb while asking the client to adduct the thumb will eventually release this area. Wedging on the opposite side of the hand (hypothenar space) produces further opening. Although the hypothenar movement is subtle, there is a gesture like grasping with the base of the hand that will help this opening.

(D) Getting the feel of tissue is an ongoing study for a bodyworker. The ultimate goal is to move the fascial sheaths in such a way as to restore elasticity. Some cues: Lift the tissue, try not to compress it. Be sure that you are taking the tissue in a direction rather than compressing it to the bone. Be attentive to anatomy; fiber direction will often inform you about the depth of tissue you are influencing. Try not to overwork tissue; when new stretch has been achieved, let the tissue rest and integrate. Know that a tense surface layer will usually have fascial fibers going in many directions.

(E) A special approach to tissue involves going across the direction of tissue fibers. This is not a common maneuver; it can be very helpful in the right place. In carpal tunnel syndrome, the retinaculum, a thin binding sheath around the wrist, responds well to this approach. It is also useful where tissue is very tight but not in spasm—behind the elbow, on the arm just below the shoulder joint (junction of the trapezius and deltoid), and just above and below the spine of the shoulder blade. Care must be taken that there is good support under a structure being worked in this way.

(F) One of the more subtle aspects of bodywork is recognizing and asking for appropriate movement. Most kinesiology texts describe range of motion; this is not exactly what we are looking for. We want to define and use the initial gesture from the "home" position. For example, the home position of the elbow while lying on the back is pointing away from the trunk. This is not the "anatomical position" described in texts. Normal movement here in our terms is the ability to slide the elbow away from the body and back without twisting at the elbow or elevating the shoulder.*

When lying on the back, the home position of the scapula is flat against the ribs, part way down the back. In normal movement, the scapula does not rise with movement of the arm. In fact, it drops slightly as a counterweight as the arm is raised. When lying on the back, the home position of the wrist allows the palm to rest flat with elbow pointing away from the trunk. When raising the hand,it should be possible to lengthen through the palm by first raising the fingers and then raising the rest of the palm in sections ***(Fig. 23-4).*** Flexion is the same rolling gesture in reverse.

(G) Using movement allows freeing of the structure at a level unattainable with the use of manipulation alone. However, this must be precise, educated movement, as we have described above in the case of the arm. It is

*For an excellent exposition of this concept, see Ida P. Rolf, *Confinia Psychiatrica,* Vol. 16, pp. 77-78, 1973. Available from the Rolf Institute, Box 1868, Boulder, Colorado 80306.

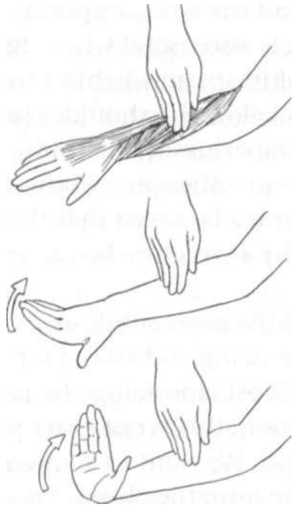


Figure 23-4
Wedging the muscles of the forearm in combination with movement of the hand.

generally not possible to use movement early in manipulation because the structure is too compressed to get accurate movement. There are exceptions, of course. With some manual assist, correct movement may be possible early on.

How to Make It Last

The element of time is important in bodywork. We have talked about not diving in before the structure is ready to open, of preparing the way. Another aspect of timing is the integration that happens between sessions and after a group of sessions. This is an example of latency in the learning process. It is just as necessary to allow time for integration between work as it is to do the work.

Client education is an essential part of bodywork. Ideally this has been happening in an ongoing way throughout the sessions. A primary goal of such education is refining the ability to sense physical change. There will be changes in stance, shoulder height, position of the arm—the best time to notice these is when the change is new. The mind learns best by comparing sensation; when change is recent, the comparison is most vivid.

Too much information can be overwhelming. A glut of new body sensations is merely confusing. Keep in mind that in the period just following bodywork, body and mind are in a fluid state. One or at most two new things to focus on is all that can reasonably be incorporated.

One of the client questions that bedevils the bodyworker is "Am I doing it right?" Am I walking right, breathing right, sleeping right? The only way out of this dilemma of "Tightness" is to help increase client sensitivity. The feel of the body is the best guide. An idealized "correct" position has to be gradually approached. For example, in a client who is pigeon-toed, forcing a straight-ahead foot position before the knees and especially the hips can accommodate the new position is damaging to the structure as well as confusing to the client.

We have alluded to the need for work on compensating patterns. Knowing where that compensation is likely to be is often a matter of experience. We list a few below that have been useful to us:

carpal tunnel	neck and shoulder
sprained ankle	twelfth rib
sciatic pain	lumbar vertebrae, dorsal hinge, atlanto-occipital junction, short leg, groin, and psoas
knee pain	hip; sometimes ankle
shoulder bursitis	ribs and diaphragm; little finger
tennis elbow	wrist

As Dr. Rolf often said, "Where you think it is, it ain't." We have used the connective tissue concept in the context of Rolfing and it has been valuable to us in opening up new vistas. We hope that it will expand your horizon as well, no matter what tradition of bodywork you practice.

Illustration Index

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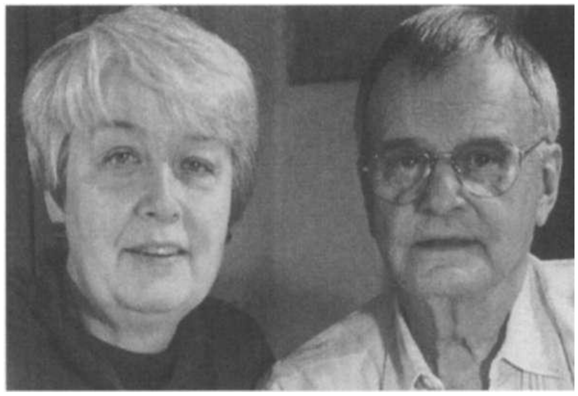
About the Authors



R. Louis Schultz, Ph.D., trained as a Rolfer in 1973. The following year he established the anatomy program for the Rolf Institute and became a Structural Patterner (later called Rolfing Movement Teacher). He has presented workshops for Rolfers in many states in the United States as well as in Germany, Italy, England, Brazil, and Australia. In 1972, Dr. Schultz retired from the University of Colorado School of Medicine and Dentistry, where his final position was Professor and Chairman of the Department of Human Biology. He is the author of over forty scientific publications. He received his Ph.D. in physiology from the University of Wisconsin in 1955; currently he practices Rolfing in New York City.

Rosemary Feitis, D.O., attended Barnard College and the University of California at Berkeley. She initially worked with Dr. Rolf on the book *Rolfing* and eventually went on to train as a Rolfer in 1969. She worked intensively with Dr. Rolf for a number of years, "keeping the infant Rolfing alive," as Dr. Rolf once said, as well as exploring some of the interesting byways of the human potential movement. In 1978, seeing the need for a less formal book on Rolfing, she edited *Rolfing and Physical Reality,* a collection of quotations from Dr. Rolf's lectures. She and Louis Schultz are co-editors of *Remembering Ida Rolf,* a collection of stories about the founder of Rolfing. Dr. Feitis received her degree in osteopathy in 1990 and currently practices Rolfing and homeopathy in New York City.

Diana Salles earned her Masters Degree in Medical Illustration from the University of Michigan. She is currently senior artist for the American Museum of Natural History in New York City.

Ronald Thompson has been a Rolfer for twenty-five years. Before that he did considerable work in underwater photography. He is currently a member of the anatomy faculty and the Rolfing faculty of the Rolf Institute and practices Rolfing in Tampa, Florida.