

Biomechanical Riding & *Dressage*: A Rider's Atlas

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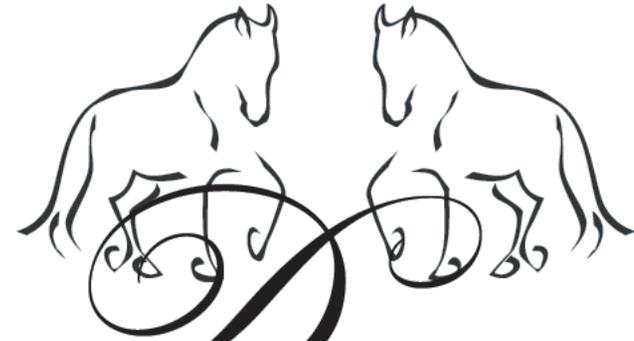
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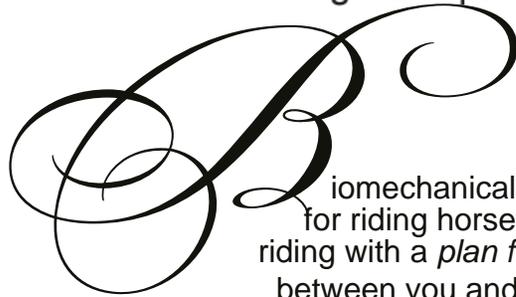
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Dressage Is In the Details:
Honing Perception and Sensation



Biomechanical riding is about a *strategy* for riding horses. It is about approaching riding with a *plan for cooperative interaction* between you and your horse. The strategy integrates principles or concepts with their execution or technique of riding. This Atlas is about the intersection of principle and technique in the literature and is not a replacement for your other books.

Riding according to biomechanical principle has the curious experiential property of simultaneous, intensely private connection to a horse while creating external features of that intimate experience that can be shared with others. This Atlas, with visual aids and discussions of concepts associated with those images, contains suggestions about ways communication between rider and horse operates. Aids using *weight* and *touch* are emphasized over other forms because of their association with processes of rider experience and with content of a gymnastic curriculum for dressage. It is up to each rider to decide how to use Atlas information in his or her own training programs.

Connections to physical and mental mechanisms of coordination patterns underlying athletic development of dressage movements are the inspiration for this book. Confidence emerges as execution of fundamental coordination patterns enables learning the feel of how a rider's body interacts with a horse. These patterns become embedded in the "circle of aids" that unifies horse and rider.

This Atlas is a "how things work" guide to the developmental strategy of dressage focused on its principal physical demands on horses and riders. As an example, moving against gravity in specific gaits requires attention, confidence and relaxation as a foundation for forward riding, straightness and regularity. Techniques for the gaits depend on knowing specific patterns underlying their generation and for transitions between them. With horses, this involves flexible balancing during long periods that their legs spend in contact with the ground (duty factors of stance phase). Muscular effort during movement involves having one or more legs braking, supporting, then propelling during a stride of walk, trot or canter. Riders need to *transmit kinesthetic knowledge to horses via the aids* as well as to *refrain from interfering with the mechanics of a stride*. This kinesthetic knowledge depends on rider ability to maintain the human center of mass in unity with the horse's center in dynamic fashion. In a real sense, skilled relaxation, friction against footing and gravity's demands frame the performance of both horse and rider, requiring integration of mind and body.

Lengthy contact time with the ground distinguishes the equestrian discipline of dressage from racing disciplines where horses have quicker stride rates and cover relatively more distance in suspension. The central set of biomechanical principles for dressage describes the way horses manage to balance their own weight along with the weight of their riders as they maneuver. While covering ground in suspension is important, especially in extended trot or canter, horses developing toward the High School reduce the "air time" of their gaits as a proportion of the time they keep at least one foot on the ground.

Central to developing the "library of skills" which support activities of dressage mounts and their riders are changes within and between gaits, or transitions. Transitions require sustained fluent motion in deliberate tempo, accurate timing of leg movements, stability during balance on grounded limbs while achieving specific leg positions in the air. As the High School is approached, these *demands for coordination and balance increase for both partners*. Dressage transitions, as you might understand from their requirements, involve strains on the whole horse. These strains are documented in the equine veterinary literature: parallel studies on horse transitions have even been used to investigate gaits in ghost crabs!

Biomechanically, transitions argue for primacy of particular gaits for dressage. Gaits are based on timing of leg movements: they establish types of walk, trot and canter for the discipline. Walk movements overlap other gait patterns, making it "first among equals" as a foundation for gymnastic training. Finally, if transitions are carefully practiced, their brief moments of strain provide incremental progress toward strength, flexibility and balance.

Subtle and potent connections radiate from performance of effective dressage transitions to collected gaits, extended gaits and flying

changes of leg at the canter. Because coordination of transitions within and between gaits succeeds most effectively in relaxation, their correct practice enhances the extraordinary capacity of equine backs to engage in complex motion in three dimensions. Strengthened by dressage transitions, a horse is ready to enhance its range of lateral bending, which has been measured directly for sections of the back (thoracic spine). Lateral bend is generally combined with axial rotation and also occurs with flexion/extension. Each gait has a unique sequence of these three dimensional motions of the back. The Atlas helps riders learn these patterns from the horse and make adjustments with their aids of weight, seat and legs in order to ride dressage movements (Chapter Five).

“Throughness” is another focus of the Atlas, a signature of confidence residing in the whole training. This is a prized quality in a dressage mount, deeply connected to fluent skill at transitions. Often described as “absence of resistance” or “immediate responsiveness” to a rider’s aids, it has a physical basis in even development of structures that maintain range of motion in the whole spine and trunk. Mentally it proceeds from trust in clarity of aids. As resistance is replaced with expertise at balance, a natural but negative way of bracing the body is superseded by a positive orientation of poise: the emergent quality is called “throughness.” Its sensation is supported by a perception of freedom of movement arising from concordant development of mental and physical skills.

Balance for throughness and its manifestation of poise may be developed incrementally from careful work with transitions. During this process, riders develop insights about the feel of unity and harmony with their horses.

Because this is an Atlas rather than an instructional manual for equitation, readers are offered a map to a territory of attainment of goals rather than prescriptions. ***The general goal is to develop a partnership between horse and rider.*** Where aids are indicated, they are offered as possibilities that have been tested by a range of horses and riders. These ideas are intended to indicate directions of endeavor for inquiring riders.

Structural visualizations of technical information enable a reader’s evaluation of the ***outer expression of internal structures.*** Anatomy, gaits and interactions between horse and rider are an entry point for learning how a rider senses gait patterns as muscle movement. There are also suggestions for interpreting equine responses to aids. Because transitions between gaits are within the anatomical core of dressage, an internally consistent system of aids for achieving fluent, balanced changes of gait is offered (Chapter Five).

Technical information displayed in this Atlas is derived differently from traditional atlas displays. These Atlas IMAGES ARE NOT DRAWINGS arranged in series or tables, unless specifically identified that way. Instead, images are printouts of computer models of horse and rider checked against frames from digital video recordings of gaits. Some gait dy-

namics are also derived from those records. Atlas images also incorporate anatomical information from veterinary and medical sources. Differences between model output and drawings is crucial because drawings, no matter how talented the artist, show what is imagined or expected to happen. A model or video series, in contrast to drawings, is not perceptually bound. Subtle distortions of anatomy or leg positions in drawn gaits are often not checked against appropriate visual standards, although tracing of photographs does help accuracy.

Animated model printouts in this Atlas are checked against video frames, X-rays and photographic stills so they are not subject to guessed outcomes. All material was checked with horses ridden or worked in hand or free longed without tack. Free longing tested the horse’s understanding of its training without the complications a rider might bring to a dressage movement or gait.

Finally, a presentation decision was made to use a digital capability of computer models to show diagrammatic transparent representations of muscles. Transparent layers of structures allow readers to “see into” activity of selected muscles that strongly affect dressage performance.

It is hoped that riders, trainers and judges will feel enabled by these imaged summaries when designing their own courses of action for a gymnastic dressage curriculum. To this end, details of each topic are discussed in wider context. A unique feature of these summaries is their explicit connections to gymnastic character of transitions between dressage gaits, strategies for training and work in forms of dressage walks.

This book aims to empower its readers to take their own competence as an agent of positive change. Atlas information is focused on two levels: explanation of riding sensation (kinesthetic learning) and visualization of the mechanisms that produce those sensations. Cycling between theoretical yet useful concepts and working out connections with practice is a means to unite your own selections from your riding library to work in the arena. In addition, the book has an annotated list of relevant readings to connect some equestrian literature with this atlas.

Chapters are organized in a sequence where technical content provides a visual guide for a reasonable process of training, with content and process interacting to produce many possibilities for learning trajectories.

Each Atlas graphics page belongs in a series, but is also independent in terms of the idea it portrays. This allows readers to decide which “chunks” of concepts to investigate, or to follow a thread of reasoning through the chapters and into their own libraries. In this way I hope to help foster a unique emotional and physical relation between you and your horse. In other words, you connect with what you already know for advancement of your own growing edges.

Summary of Biomechanical Riding: Visualization and Sensation

This book is about how biomechanical or diagonal riding **LOOKS** and **FEELS**. It is a perceptual “road map” for a guided tour of this kind of riding, which is also called the “spiral seat” or the “independent seat.” It is so named because it is based on the action of long spiral tracts of muscle which both horse and rider use for moving.

Riders, instructors and spectators have different simultaneous experiences of this art. Riders and their horses operate in the kinesthetic realm of **FEEL**. The goal is kinesthetic unity between partners. Instructors need to know how a movement **FEELS** based on their riding experiences and how that **FEEL** translates into what they **SEE**. Spectators value the visual aesthetic and technical qualities of a performance in competition or training.

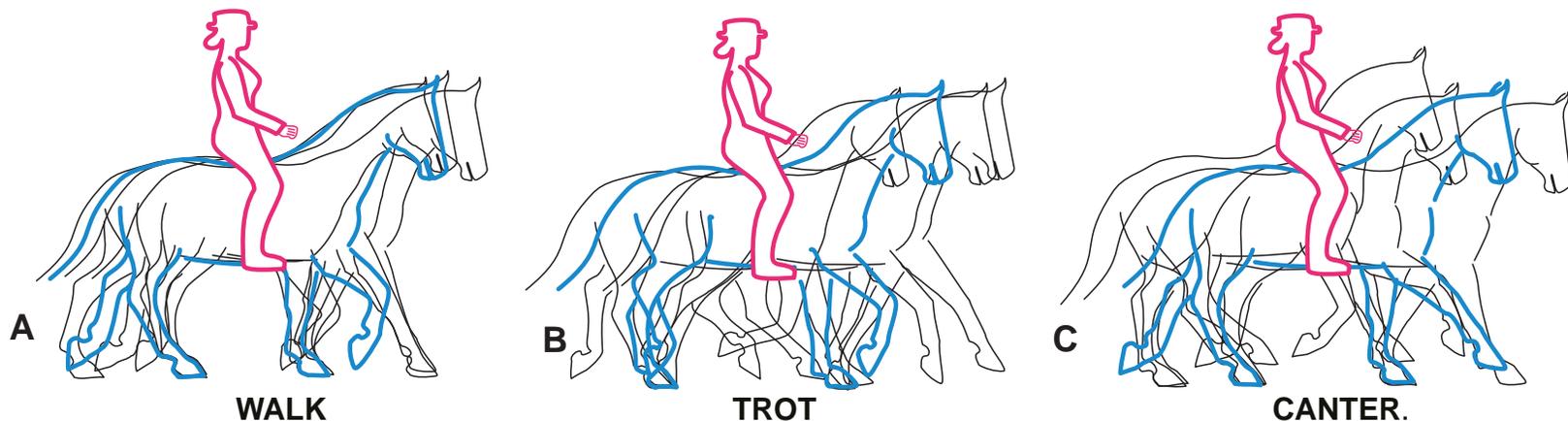
Dressage is literally a “contact sport” not only because of kinesthetic connections between horse and rider but because of the relatively long times the moving horse moves keeps at least one leg on the ground (limb contact time). The diagonal pair moment of a gait illustrated in the images below is particularly significant for dressage. Knowing how leg positions of each gait **FEEL** during a stride is pivotal to performing fluent, prompt transitions between or within gaits. It is the **sensation** of correct transitions and gaits that opens the way to coordination, confidence, strength, enhanced range of motion and grace that are hallmarks of the mature art and sport.

This is what biomechanical riding **LOOKS** like: there is a moment in each gait when a *diagonal* pair of feet is on the ground and the horse contracts the muscles of the trunk to pull itself forward over the grounded pair of legs. During movement over the grounded or stance

pair, the horse is momentarily in **RELATIVELY STABLE, YET DYNAMIC BALANCE**. **Perception of the sensation of back muscle movements allows a rider to time aids with diagonal pair support** during transitions. The horse is literally caught between the effect of its mass loading its lower limbs and the effect of aids on the muscles of its trunk that affect leg placement. This means that concord between rider and horse centers of mass plus well-timed, exact leg and seat aids have enormous influence on the quality of performance.

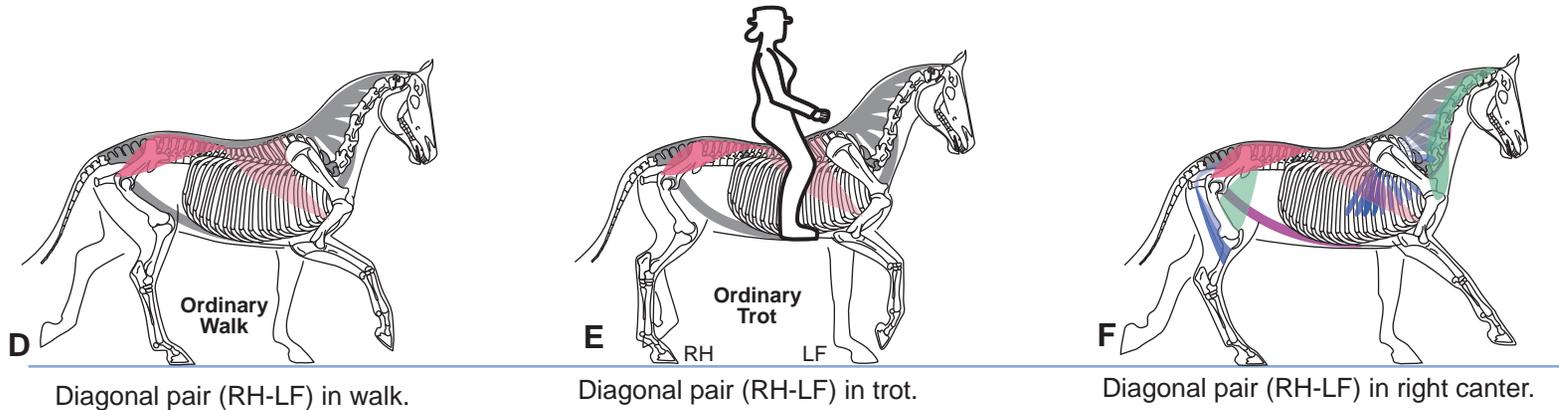
Dynamic balance, especially for horses unfamiliar with dressage, begins with a rider. The **SPIRAL SEAT** achieves this in several ways. First, a relaxed, aligned seat follows gait patterns because a rider **RIDES WITH CORE** muscles, keeping centers of mass **UNIFIED** between partners. Second, the seat is **INDEPENDENT** with quiet hands because shoulder blades are kept free to slide on upper back muscles. Under these conditions, motions of gaits do not transmit themselves to hands. They are absorbed by elastic joints in the legs, avoiding overwhelming the seat when the horse offers a swinging back. Proper balance in stirrups that avoids bracing against the contact enables dynamic reactions to a horse’s movement. Three, the **CORE IS STRETCHED** from neck to seat by holding the chest wide with deep back muscles. These control the configuration of ribs at the rear of the upper torso. Under these conditions, a rider can offer an “elastic pillar of support” while the horse moves through its lessons.

Biomechanical riding seeks communication between horse and rider that results in continuous, connected movement. Central to the aesthetic quality of the felt and viewed performance is the quality of fluent grace. In the illustration below you can see the origin of that flow, that “music of the gaits” in the *overlapping motions of the legs* (A-C). This is an analogy with “legato” passages in music, where notes overlap in lyric manner, rather than being discrete, “staccato” events.



Summary of diagonal stance and swing leg positions during one stride.

This is what you **DO** to ride with the biomechanical technique. Keep track of the *diagonal pairs* of the gait you are riding (left or right hind foot down in each gait (some riders prefer keeping track of the forelegs). Red in the images (D-F, X, Y) indicates a contracting muscle and pink indicates a relaxing muscle (latissimus dorsi of forehead, medial gluteal of hindquarters).



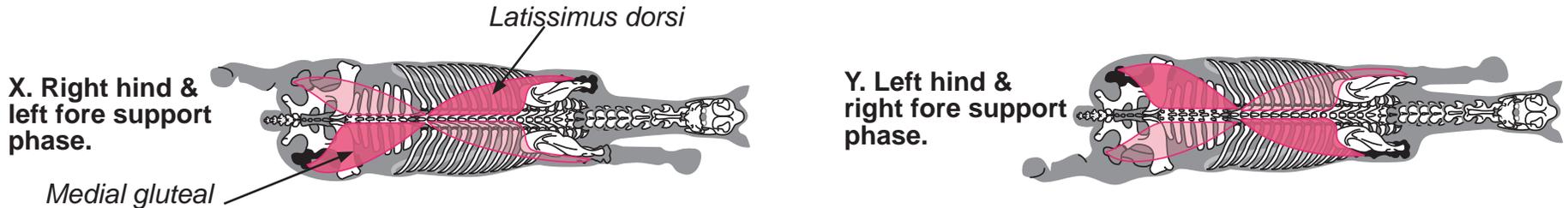
WALK

TROT

CANTER

“X-ray view” of diagonal stance and swing leg positions during one stride.

During a stride of walk, trot or canter, you are able to follow the pattern of motion of the back muscles, the swing of the rib cage as the horse moves. After you learn these patterns, you are skilled enough to help the horse enhance its movements. The surprising thing is that an observer will see you in relation to the horse and conclude you are “motionless.” But you will be making very active muscle movements as required to “go with” your horse. That is the meaning of “invisible aids”: the phrase indicates the spectator’s perspective while yours is sensation of motion and quite different!



This is what diagonal riding **FEELS** like. Major muscles of the back are arranged in sections with their fibers aligned *diagonally*, laid out as a muscular “X” with its junction slightly behind the saddle and its ends at each of the four legs. Riders sit over the “waist” of the “X”, influencing gaits and transitions from a central position. Contractions of major back muscles along with swings of the spine are especially noticeable when the horse’s body is pulled over the grounded diagonal (stance) pair of legs. These motions have a rhythm unique to each gait and can be learned as part of a rider’s kinesthetic “coordination library.”

Transitions for dressage are requested by aids as *changes in pattern* or sequence of movements felt under the saddle: they are not changes in balance or tempo. For transitions, you relax, keep your own elastically supporting balance no matter what the horse does, while you time the aids for conversion of one gait to another. It is important in all movements that you feel a stable location of your center of mass so it assists the horse in its own balance.

The more you understand how you and your horse operate, the more you can assist yourself in the integration of your body with the horse’s motion. Progress in this mutual understanding is one of the many delights of dressage.

Growing With A Training Tree

Many training trees or “training scales” have been proposed. The Official Handbook of the German National Federation, *The Principles of Riding: The Complete Riding and Driving System (Book 1)*, is a standard place to begin understanding basic qualities that a training program aims to produce in a horse. Its training scale is a list of activities essential for bringing a horse from field to stable environment, with a modifying comment that the content of its linearly presented list is “interwoven.” Two books of the system are intended for several equestrian disciplines, including dressage. The general aim of the German system is to produce an obedient, flexible, fit and “through” athlete. In this regard, the second volume, *Advanced Techniques of Riding*, includes show jumping and eventing in its instructions. These books are considered fundamental reading for American riders and are rich in discussions of riding technique. This Atlas is focused on dressage and its training tree reflects the interconnected qualities of a biomechanically informed dressage strategy.

“Throughness” is more than “absence of resistance.” It is a test of a horse’s ability to maintain its whole body poise: balanced posture in three dimensional space in sustainable balance while changing direction or gaits. Searching for “throughness” begins with a classically informed independent (spiral) seat. Biomechanics of our bodies yields insights into how riders themselves achieve throughness combined with straightness, then are able to transfer those intertwined qualities to their mounts. Horses can be “through” in the context of their current training. This means that they have mastered a degree of physical and mental skill at balance in response to aids, but will fail to be “through” if challenged with demands for more advanced performance. In this context, the feel or balance “on the aids” of a horse when asked to execute requests for transitions is a valuable indicator for level of training.

“Collection” is as prized a condition as is throughness, and is intimately connected with it. If it is thought of as the capacity of a horse to “gather” or to organize itself for a specific action, then it is a quality residing in both mind and body. Mentally, it involves the foundation qualities of attention and confidence, producing relaxation with tension absent. Physically, it requires that the horse be connected *through* from back (hind legs/propulsion) to front (stable posture). It follows that an independent or spiral seat uses the aids of lower body to maintain the horse in readiness for agile responses. Resistance may be either passive (untrained or undeveloped capability) or active (disobedience or blocking the aids is covered in Chapter Eight).

Passive resistance to forward movement occurs normally as horses “lean on their own bodies” asymmetrically as a way of organizing their actions. In this case throughness is not present because one or more body parts are less able to move freely than others. Failure to respond to aids may have its origin in inattention, misunderstanding or disobedience (poorly

fitted saddles are a common source of disobedience and resistance).

Prompt performance of transitions addresses issues of inattention, misunderstanding and moderate disobedience. During fluent transitions, there is incremental substitution of moments of balance for imbalance, of achieving moments of improved tempo instead of quick steps, plus increased skill at adjusting leg positions between gaits. Practicing dressage transitions makes throughness accessible gradually. Control of its body with tactful guidance of a rider functions as a reward for a horse. Adding a gentle word of praise or a soft stroke further enhances positive moments. Modest progress builds attention, confidence and responsiveness as the horse begins to find its rider is functioning as an “athletics coach.” If throughness is treated as an absolute quality only attainable after years of training, it appears as an unscalable cliff.

During gymnastic training, passive resistance is replaced with skilled balance. A natural but negative way of orienting a body by leaning on the forehand part of the spine is superseded by integration of thrust and stability, the ability to control effort evenly in the body (collection). Poise for the rider is sensation of freedom of movement. For the trainer/instructor, grace and poise arise from concordant development of mental and physical skills. Balance for throughness and its external manifestation of poise may be developed incrementally and checked at each stage of training. During this process, riders develop insights about the feel of unity and harmony with their horses. Sensing opportunities for progress opens new horizons to riders who wait patiently for “teachable moments.”

A “Training Tree” of process as a home for content grows from a seedling rooted in attention and confidence to a flowering at maturity. The developing tree strengthens its trunk in relaxation and elastic contact, enabling the horse to move willingly forward with regular steps (impulsion). Elastic connection is a fundamental process unifying thrust in dynamic stability as the content of increasingly challenging exercises proceeds. Besides maintaining beautiful movement, relaxation and elastic performance minimize injury. As the horse becomes a forward mover, it adds content “branches” of dynamic straightness: correct alignment and agility in three dimensions. Its gaits acquire expression to underline their purity.

“Flowers” on the mature tree are lightness, self-carriage, cadence, collection, impulsion and throughness. These qualities emerge from the whole training as it operates in repeated cycles that refer to crucial content in the process that maintains its living foundation in confidence.

At all stages of growth, the Tree expands its roots in attention and confidence with a goal of alert relaxation. The seedling “Tree” depends on the patience and tact of the trainer. Losing confidence at any time during the progression of mental and physical skills is a real setback in terms of time and energy. It has been said that lost confidence is as difficult to restore as replacing the fuzz on a peach.

**Learning Styles:
Suggestions of Training Strategies
That Coordinate Horses and Riders
in Harmony**

This diagram is intended to argue for incremental learning. Pieces, bits or “chunks” detailing specific content of that learning may be connected by thinking about the various “training trees” that have been proposed. While the training scheme from the Handbook of the German National Federation is a standard, many trees have been proposed. Each author of a “tree” will have reasons for that proposal and readers are encouraged to extract information from a variety of sources.

Measurements of learning indicate that the number of tasks and their timing is important for riders and for their mounts. As a program proceeds, you will come to know your horse in ways that are more specific than general advice can provide. In any case, once a task with its sensations and stimuli is recorded in immediate memory, time should be allowed for it to be processed by neuro-chemistry into long term memory. It is also crucial to know the useful attention span for you and your horse, and stay within its limits.

• Kinesthetic Learning

Active exploration of the physical world with movement and touch is the essence of this sort of information gathering. Kinesthetic learners are often well coordinated and have a strong sense of timing and acute awareness of body movement. Horses and riders may usefully connect in this learning and recall mode.

• Visual Learning

Body language and facial expression are of primary importance. Humans and horses show evidence of this sort of learning. For humans, the use of text is important. Interestingly, horses can visually discriminate sets of symbols: there is a standard set of “flash card” pairs for discriminant learning of images. What meaning equines attach to images is not known with great specificity.

• Auditory Learning

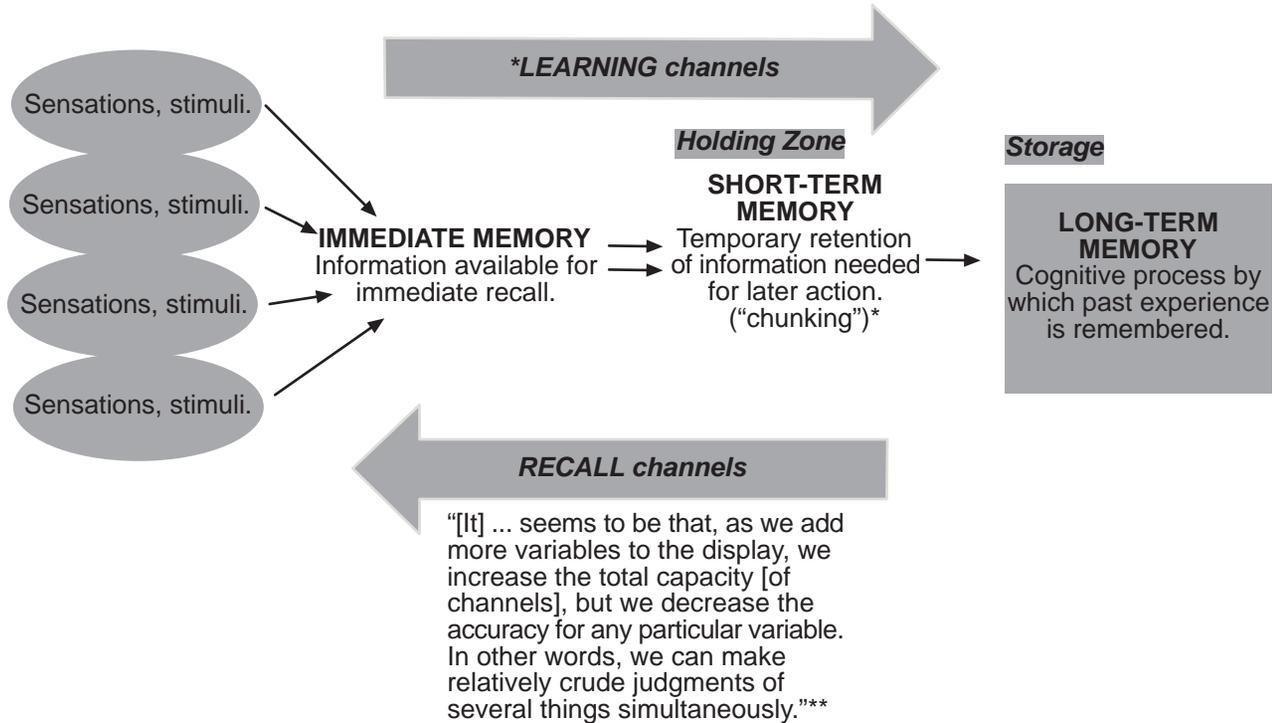
Meanings are found in tone of voice, pitch, speed of words/syllables and other nuances. Text-based information may need to be heard by auditory learners. Horses appear sensitive to those aspects of voice that carry emotion.

The diagram above has no hints about the body structures involved. This is deliberate, as this Atlas would prefer to focus on body and mind issues of the *process and content of learning*. Exact physical locations of many of these phenomena or processes is under active investigation. Some of the storage locations may be distributed locations in the entire nervous system connected by a network.

Diagram based on:

*Small, G. 2002. *The Memory Bible*. Hyperion Books. (Gary Small is a medical doctor and neuroscientist.)

**Miller, G. A. 1956. *The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information*. *The Psychological Review*, 63: 81-97. (This is a classic paper on the subject of the character of learning, written clearly and with good humor.)



“[It] ... seems to be that, as we add more variables to the display, we increase the total capacity [of channels], but we decrease the accuracy for any particular variable. In other words, we can make relatively crude judgments of several things simultaneously.”**

Growth & Flowering of a Training Tree

Red

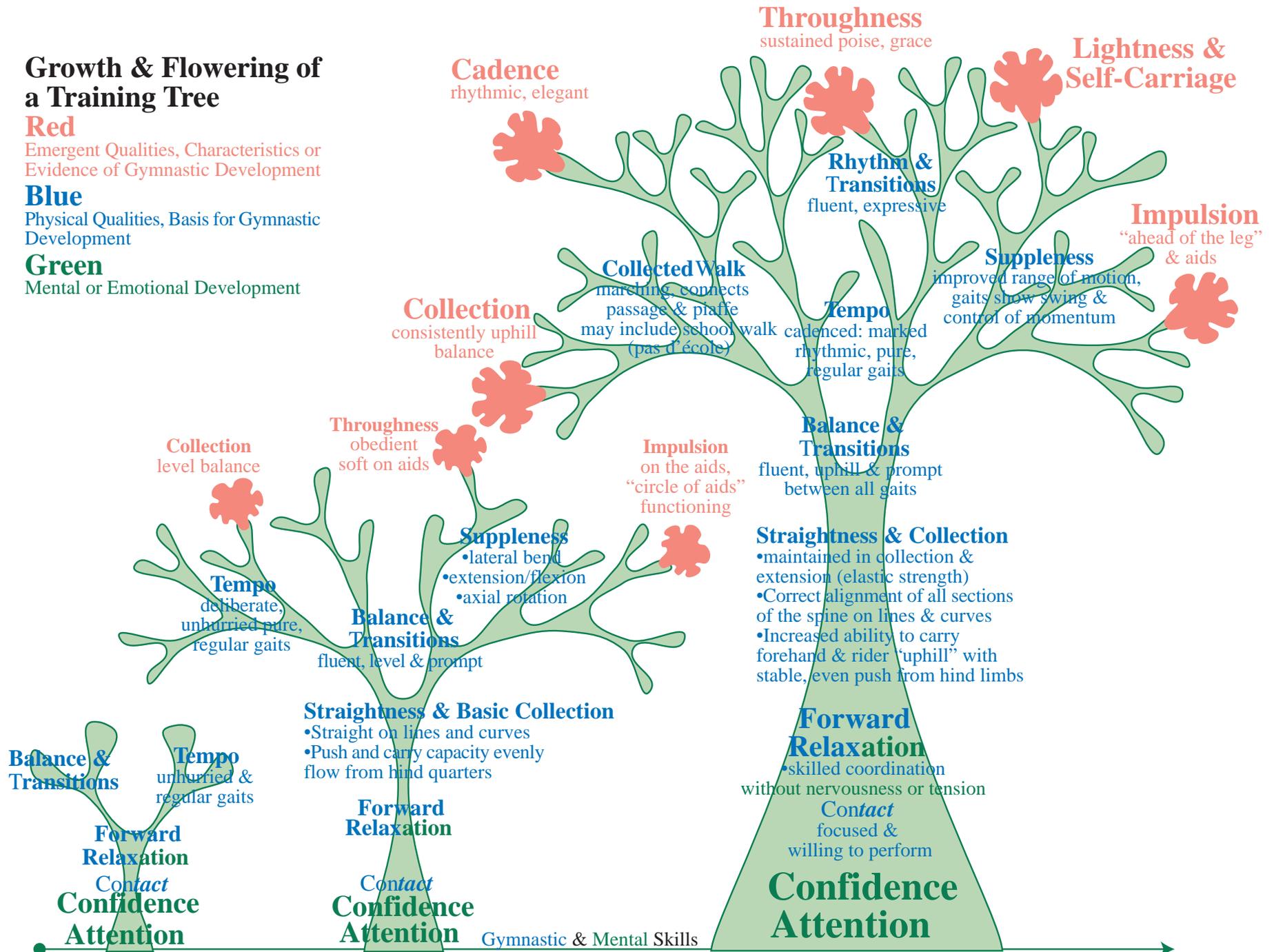
Emergent Qualities, Characteristics or Evidence of Gymnastic Development

Blue

Physical Qualities, Basis for Gymnastic Development

Green

Mental or Emotional Development



Narrower pelvis and less curving of the lower spine in men means they may look as though they are “sitting on their pockets.” But men are also at risk of overloading joints if they are not correctly aligned in the saddle or if the saddle tree does not fit their seat width. Men who ride tipped up on their thighs may find they collide painfully at times with the saddle pommel: these moments also coincide with the slipping of legs too far behind the girth.

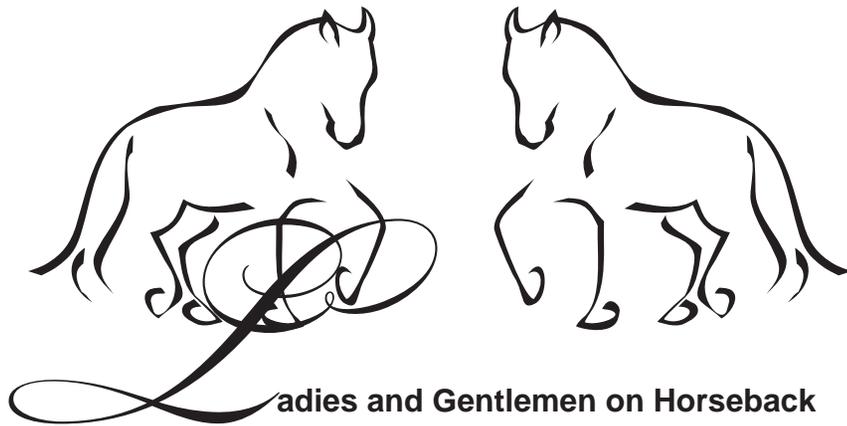
An important consideration for both men and women in the saddle is placement of stirrup bars. Many saddle makes have these bars placed too far forward, causing rider strain in an attempt to ride balanced with some weight on the balls of the feet. A saddle that is unlevel or ill-fitted will also cause riders to struggle for correct position. Compensation for instability in the saddle appears as gripping with knees, causing a cascade of problems. Gripping with thighs and knees locks a rider (man or woman) at the hip, freezing the pelvis and forcing movement from the horse's gaits to be concentrated on rider spine and knees.

Riders need open, relaxed limbs so their whole series of joints from foot to hip and lower back may safely absorb gait motions or give precise aids. Finally, shoulder blades need to float freely on their upper backs. Free shoulders disconnect actions of seat aids from rein aids (independent seat). As mediator between horse and rider, saddles must be comfortable and correct for both. If this is the case, then men and women when correct will look different in the saddle (see B in profile diagram). In spite of different appearance, an upward-downward elastically stretched body, a functional Spiral Seat is possible for both.

Men and women tend to have the same problems with the aids. These include misalignments (breaking at the waist, chair seat, toes out, protruding elbows, tucked in chin), tension (especially in lower back, fingers, hand, wrist, hip and shoulder, a clamped jaw), and “driving” with the seat (vulture-like motions with the head and neck, leaning behind the vertical, bracing against the rein with the stirrups), banging at the horse's rib cage with lower legs, labored posting (weak internal-external abdominal muscles, weak muscles on the front of the thighs). Some of these “deadly sins of dressage” have very colorful names... and all interfere with the desired unity of performance between horse and rider.

Who, then is the “best” rider? The rider who, from a spectator's external perspective, looks quietly relaxed with respect to the horse. The man or woman who, from *internal* sensory perspective, makes only those body motions necessary for “invisible” aids, realizing that this **feels very actively connected to movements** of the horse. The rider who, from a horse's perspective, is able to “go with,” or even enhance, the performance: **the rider who is “invincibly soft.”**

Oliveira, Nuño 1988. *Reflections on Equestrian Art*, Translated by Phyllis Field, J. A. Allen, London.



Ladies and Gentlemen on Horseback

Skeletal and body differences between women and men are often the subject of arguments concerning the way they ride horses. However, as Écuyer Nuño Oliveira says “Only a rider who has a good position may obtain *valid* results from his horse. ... *It is only with a good position and a supple horse that the rider may succeed in stabilizing his hands, thus being certain of never pulling on the horse's mouth.*” (emphasis mine)

Men are more muscular, with different, usually shallower, angles in spine, pelvis and thighs. This has consequences for how men and women **look and function** in the saddle. The lumbar (lower back) curve is greater in women and their wider pelvis is tilted toward the front, which makes for the sway-backed appearance often found in women. Ladies are arranged for carrying babies so their seat bones intersect with the saddle differently from men. This also means that their thighs are wider apart than in men, so their thighs angle in more toward the knee (knock knees, an exaggerated angulation, is more common in women than in men).

A wide pelvis has important health consequences for women: their knee joints are very easy to strain, leg joints are subject to overload. Structures at risk include the medial collateral ligament of the knee (can become overstretched), the lateral meniscus, the cartilage-covered joint surfaces of the external condyle of the femur and the lateral tuberosity of the shin. Any of these leg parts may be loaded in undesirable fashion. So women should take care to avoid tack and riding alignment practices that produce discomfort and premature wear on joints.

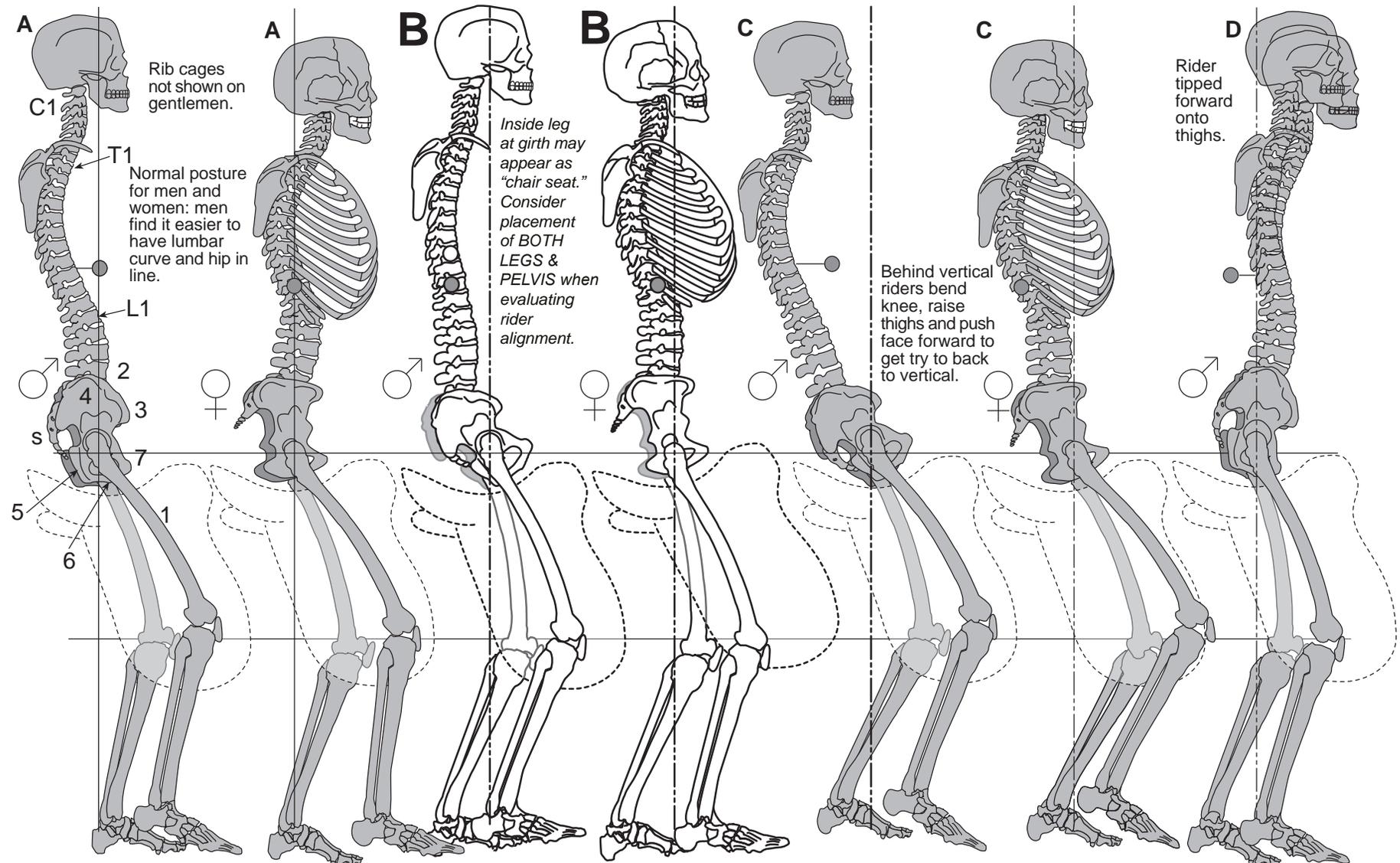
“Four Horsemen and Three Horsewomen of Dressage” in the saddle.

A. Normal position of pelvis and spine. **B. Top of pelvis tipped slightly to rear, spine stretched upward: preferred position.**

C. Pelvis tipped to rear, collapsed chest. D. Pelvis tipped forward, hollow back but trying to stretch upward; back image has given up stretching upper body. Note different relative positions of lumbar curvature and hip joint for men and women.

Parts of Pelvis: 1-thigh bone (femur) 2-iliac crest 3-anterior superior spine 4-ilium 5-ischial tuberosity 6-lower ischial ramus (seat bone) 7-lower pubic ramus S-sacrum (fused vertebrae) *Parts of Spine:* C1-1st cervical vertebra T1-1st thoracic vertebra L1-1st lumbar vertebra s-sacrum (fused vertebrae) Gray circles represent rider’s approximate center of mass.

After: Heinrich & Volker Schusdziarra 1978. *An Anatomy of Riding*, and Erik Herbermann 1989. *Dressage Formula*, Second Edition (has x-ray images of these positions on page 139).



Male and Female Skeletons With Views of the Seat Bones

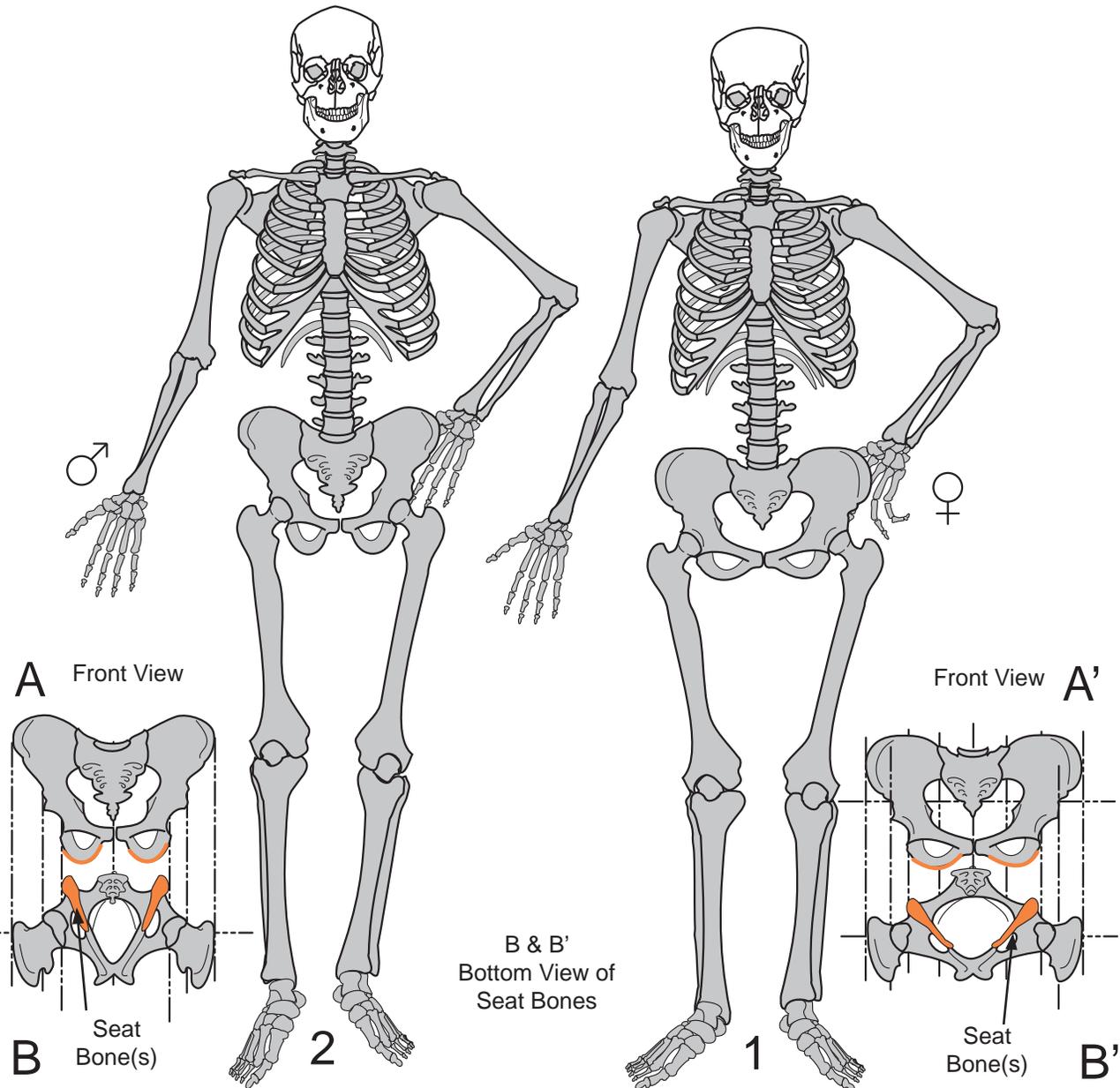
A and A' are front views, B and B' are views looking at the pelvis from the bottom up to show seat bones (orange). Note that for women, seat bones are more widely spaced with a wider angle between them than for men.

Saddle design, especially the shape of the twist, as well as length available for thighs, should take into account the different construction of the lower body for men and women. Because saddles are the interface between horse and rider, care should be taken to ensure a comfortable fit in terms of width and shape of the seat.

Stirrups are suspended near a top anchor point of the saddle (the stirrup bar) as though they are men's still rings in gymnastics. Stirrup bars should be placed so they allow a rider to balance in the stirrups without straining to maintain position. Relaxed balance during movement is a key to the use of consistent, exact weight aids. Balancing at the ball of the foot where the big toe joint is located permits a rider to absorb motion of the horse with ankle, knee and hip, unloading the lower back. An elastic, balanced rider is a comfort to the horse, rather than being a stiff load. The position is determined by gravity. The other two positions are to fall backward or to fall forward. Saddles with improperly placed stirrup attachments encourage riders to grip with their thighs, an action that simultaneously blocks mobility of the pelvis and interferes with the action of the horse's shoulder.

Back of balanced position, a rider will fall behind the horse's motion. In front of it the rider is ahead of the movement. Above correctly placed stirrup bars, a rider can maintain concordant position with the horse's center of mass, provided the saddle is placed behind the withers where it does not interfere with the action of the shoulder blades.

What is the reason for this attention to supple alignment? **Throughness begins with the rider!**



Exercises For Internal Trunk Muscles & the Independent Spiral Seat

There is a reason riders have difficulty in moving their seat bones in synchrony with a horse's back muscle motion. That is because leg muscles plus the ilio-psoas muscles of the internal trunk help move the pelvis when standing (dotted outline). However, in the saddle, mainly internal muscles are available to move the pelvis. In most people, those muscles have not been strengthened to carry the load of the lower body as the horse moves. **YOU RIDE WITH YOUR CORE MUSCLES TO AFFECT THE HORSE'S CORE ALIGNMENT.**

1) Ilio-psoas Lift (lower body independence - see image at right)

In addition to strengthening and coordinating internal riding muscles, this exercise helps develop independent movement in the upper and lower body. It is important that during the movements of your pelvis, ***your shoulders remain still, relaxed and level.*** It may be helpful to hold the back of a chair with a hand opposite the hip you are moving, or to stand in a doorway where you can see the results of your movement in a mirror.

This exercise, where a *relaxed leg* is lifted just clear of the floor with as few muscles as possible (C), uses the mass of the lower leg as a load for the ilio-psoas system. Relaxation of the limb not only lets it function as "dead weight" but assures freedom of your hip joint. As with any exercise program, check with your doctor for its appropriateness for your physical condition.

With shoulders level, stand on one leg with both knees lightly flexed. Lift one leg clear of the floor and move that hip up/in several times before setting the foot down. Sets of ten to twelve repetitions are suggested for this exercise. Change from one leg to another and try not to become fatigued when just starting out, as old habits of muscle movements will take over. After you are accustomed to this exercise, you can increase the number of sets.

2) Independent Seat A (lower body independence)

A second exercise for the spiral seat involves holding the back of a chair with both hands while you march in place. Be sure your elbows are flexed, your wrists relaxed, your fingers are closed (not clenched) and that your shoulders do not move while you march. If they do, the likely culprits are tight muscles of waist and lower back, or shoulder blades "stuck" to your upper back. Without this "disconnect" of lower and upper body, bouncing in the saddle is transmitted to your hand, making the contact unstable.

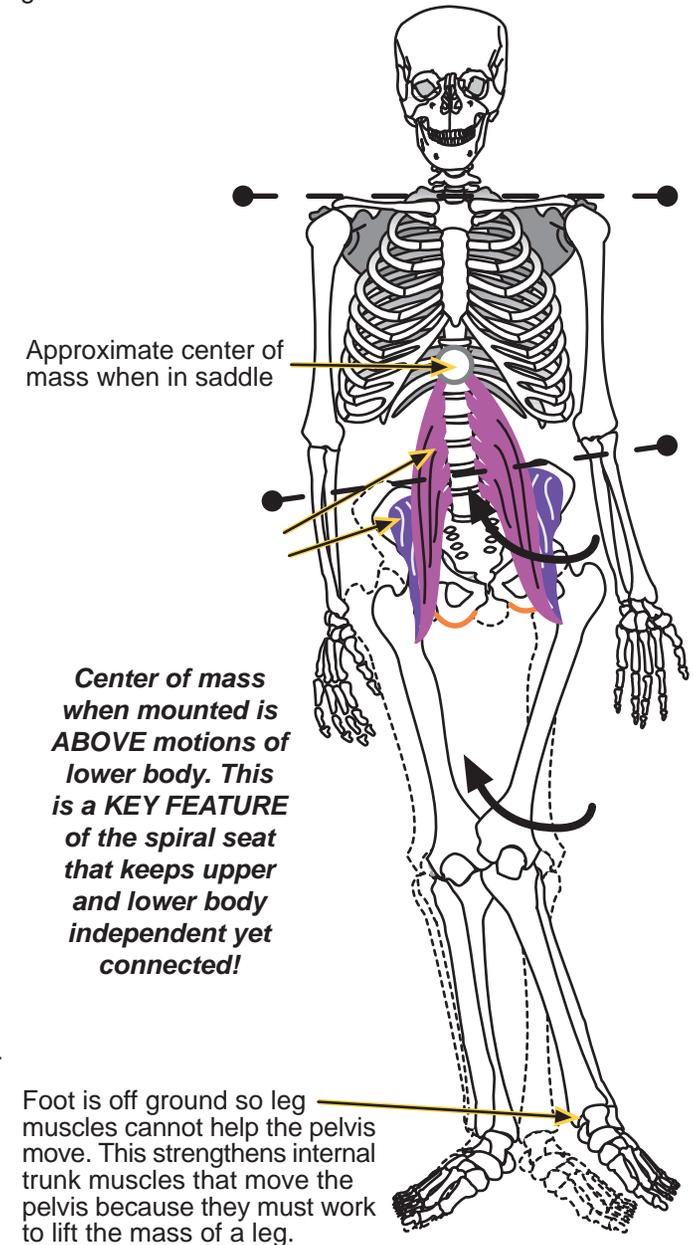
3) Independent Seat B - Shoulder Shrug (upper back independence - see pages 18 & 19)

To test for free shoulder blades, stand as you were in the previous exercise and shrug your shoulders *without pressure on your closed hand(s)*. If you push on the chair, then you are not "through" somewhere in your shoulder girdle (usually elbows are rigid or your shoulder blades are not free). A test for stuck shoulder blades is to place a finger at the notch in your sternum and feel it move up and down as you shrug one shoulder. Caution: this exercise may be uncomfortable for people with neck injuries, upper back spinal problems or rotator cuff injuries.

4) Test Mobility of Pelvis (independent seat in relaxation)

Set both feet on the floor exactly parallel and move your pelvis. You will be ***restricted*** to moving both seat bones together. Now offset your FEET and note that your pelvis easily lifts

and lowers with ***alternating*** seat bones. The offset legs (forward leg is generally inside the bend, back leg on the convex side of the bend) automatically enables correct mobile seat aids, allowing riders to relax into the horse's gaits.



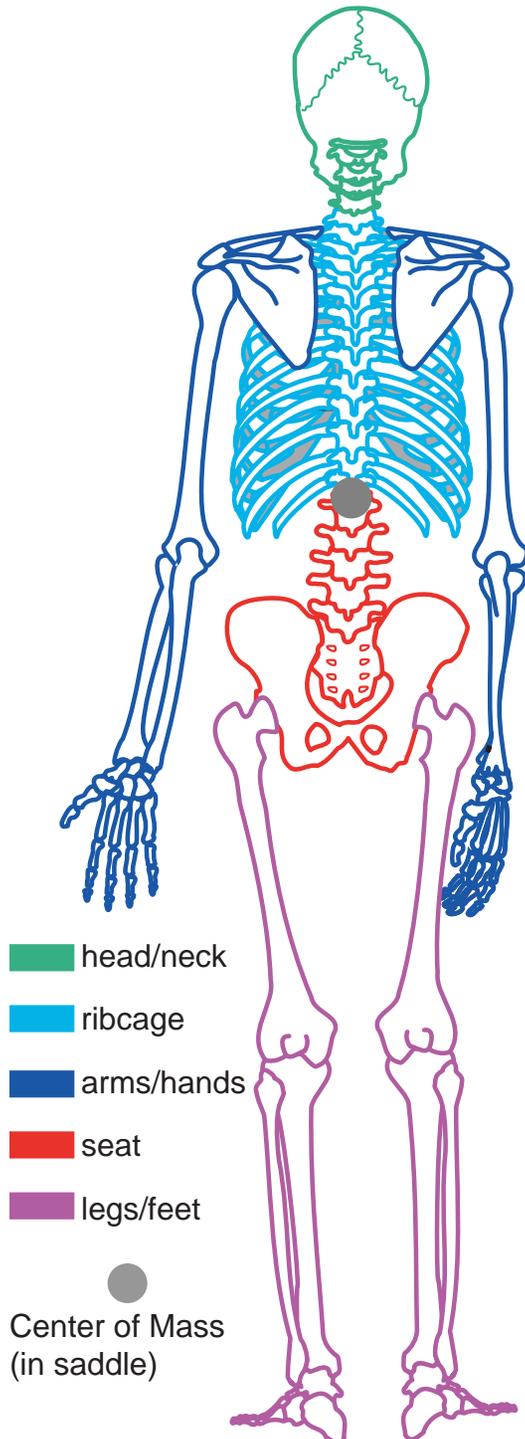
General Regions of the Independent Spiral Seat

This is a somewhat arbitrary division of the human body into functional regions in terms of an independent seat. For instance, the head and first five cervical vertebrae are included in a group and the lumbar spine is included with the pelvis. I have used particular **core muscle groups** to make these divisions: you might wish to make your own after studying anatomy and riding. **Each region of the body makes specific contributions to the information sent to the horse via the rider. In turn, independent position facilitates reception of information about the performance of the horse in the "circle of aids."** Use of core muscles, those that are next to the skeleton, is one of the reasons skilled riders appear to use "invisible aids." Such aids are almost impossible to see at the body surface because they are overlain by intermediate and shallow muscles and blend rider action with horse motion. Each rider is acutely aware of the activity of these core muscles and so is the horse. Observers view an apparently "still" rider because it is natural to evaluate a mounted person in relation to the active horse. Perhaps differing perceptions between pupil and teacher in this regard have led to misunderstandings when instructions are given to "be quieter with your body," leading a rider to stiffen as a natural idea of "being quieter."

One crucial feature about the spiral seat is that it keeps the rider's approximate mounted center of mass centered (gray circle) so it may be effectively aligned for weight aids. An example of a weight misalignment would be to cock the head in the opposite direction of travel or to drop it forward: the head weighs about 10 to 12 pounds. Henri St. Cyr (Swedish individual and team champion at Olympic dressage in 1952 and 1956) was known to remark about weight aids for rein-back, "Use only your chin!" This indicates how influential small changes in head alignment can be! And by obeying the dictum of forward riding at all times, it eliminates rather ugly, sneaky pulls with the hand to produce a single rein-back or to perform a *shaukel* (counted series of rein-back and forward steps in absolute coordination and straightness). A second crucial feature of the independent seat is that it requires RELAXATION TO ACHIEVE SYMMETRY. This is because, no matter how athletic a rider might be, tension in the stronger side of the body will pull it out of alignment front to back or right to left.

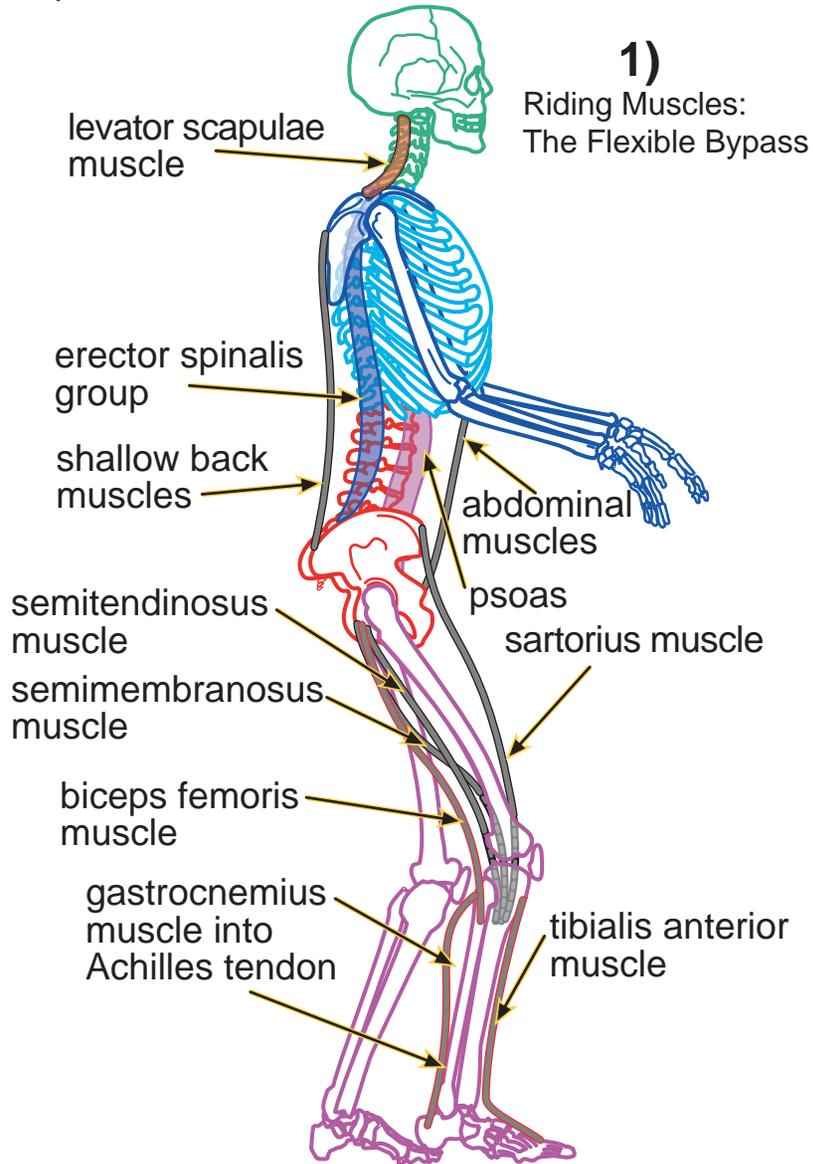
In addition to the four exercises given earlier to assist in attaining an independent seat, riders are urged to adopt an exercise or a dance program that helps to isolate motions in various regions of the body. Classical riding is accurately described as "dancing with a horse." To that end, a dancer's isolations are important in the library of physical skills. Once a reasonable degree of independent movement of body parts has been attained, movements in dressage will be more easily learned. Learning includes the process skill of "reprogramming" coordination to accept new content. A common concern of persons new to dressage is their lack of knowledge about specific positions for gaits, transitions and lateral work. Working to be more correct in relaxation will help those new to the discipline to worry less and to enjoy acquiring new knowledge. Testing coordination and position unmounted is a valuable aid in learning, re-learning or polishing riding techniques. This is especially true for lateral exercises such as leg yield, shoulder-in, shoulder-out, haunches-in, haunches-out and half pass. All transitions between gaits will come more fluently, as will maintaining a constant degree of bending for riding circles of a specific size.

Horses are very sensitive to rider position, even imitating rider asymmetries and stiffnesses! If saddling is not an issue when problems arise, rider position and degree of relaxation are good candidates for the creation of resistances or misunderstandings from the horse.

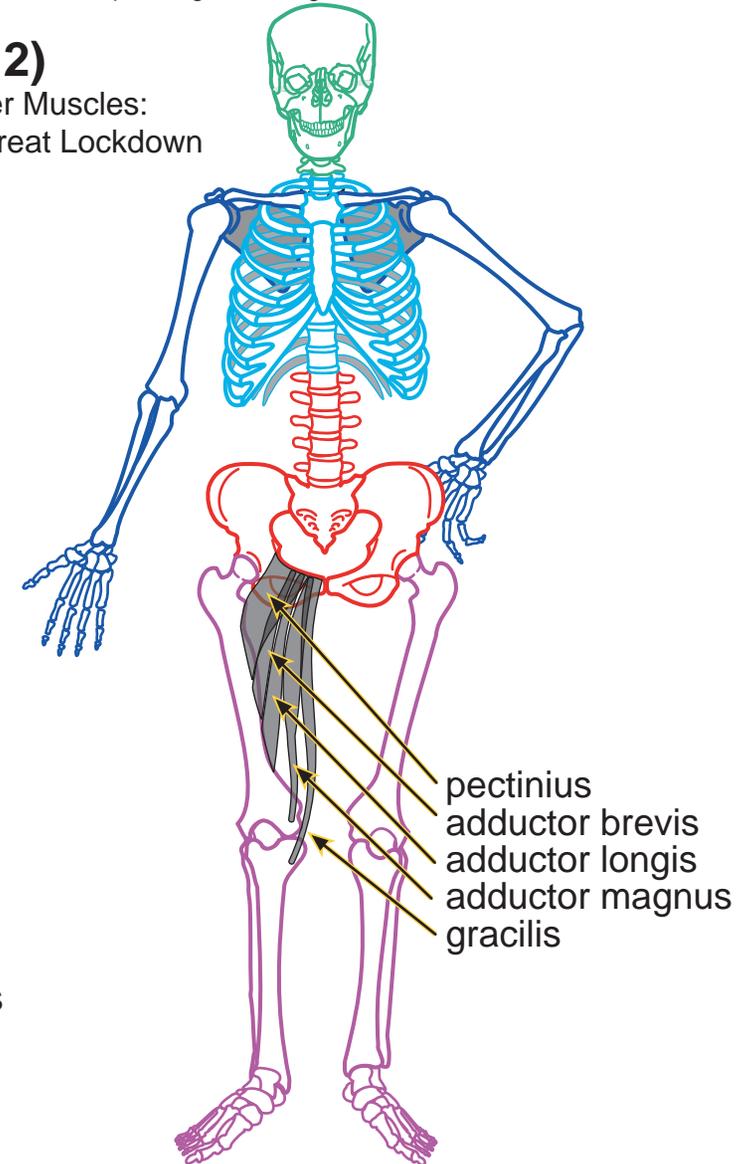


Summary of Muscles to Use For the Independent Spiral Seat (and those to avoid)

Riding muscles (1) are those that bypass joints and wind around the body like a Chinese finger trap. They are the basis for fluid motion at joints and for isolating one region of the body from another. On the other hand, powerful gripper muscles (2) restrict motion at the critical hip and knee joints. These interfere with the classical seat in major ways, largely disabling independent actions of the seat and leg aids. It is not uncommon to see riders who grip with their thighs kicking with the lower leg in a largely ineffective attempt to send their horses forward. But gripping and kicking are contradictory actions, where the gripping legs inhibit range of motion of forelegs, restricting impulsion, so the horse comes to ignore the leg (or can become irritated). Riding muscles of the deep core, assisted by shallower muscles, permit subtle, accurate seat motions. They emphasize ELASTIC CONNECTION to reins, upper and lower body ELASTIC STRETCH for half halts and controlled LIFTING/LOWERING of the pelvis, rather than pushing or driving with seat and a “braced” back.



2) Gripper Muscles: The Great Lockdown



Regions of the Spiral Seat

- head/neck
- ribcage
- arms/hands
- seat
- legs/feet

**Selected Core Muscles of the Trunk:
INDEPENDENT SEAT - 1**

Importance of isolations in athletically skilled relaxation can be seen in the diagram at right. This musculature is intricately interconnected. Neck muscles (especially the *levator scapulae*) that lift the shoulder blade are blocked if the *rhomboides major* is tensed.

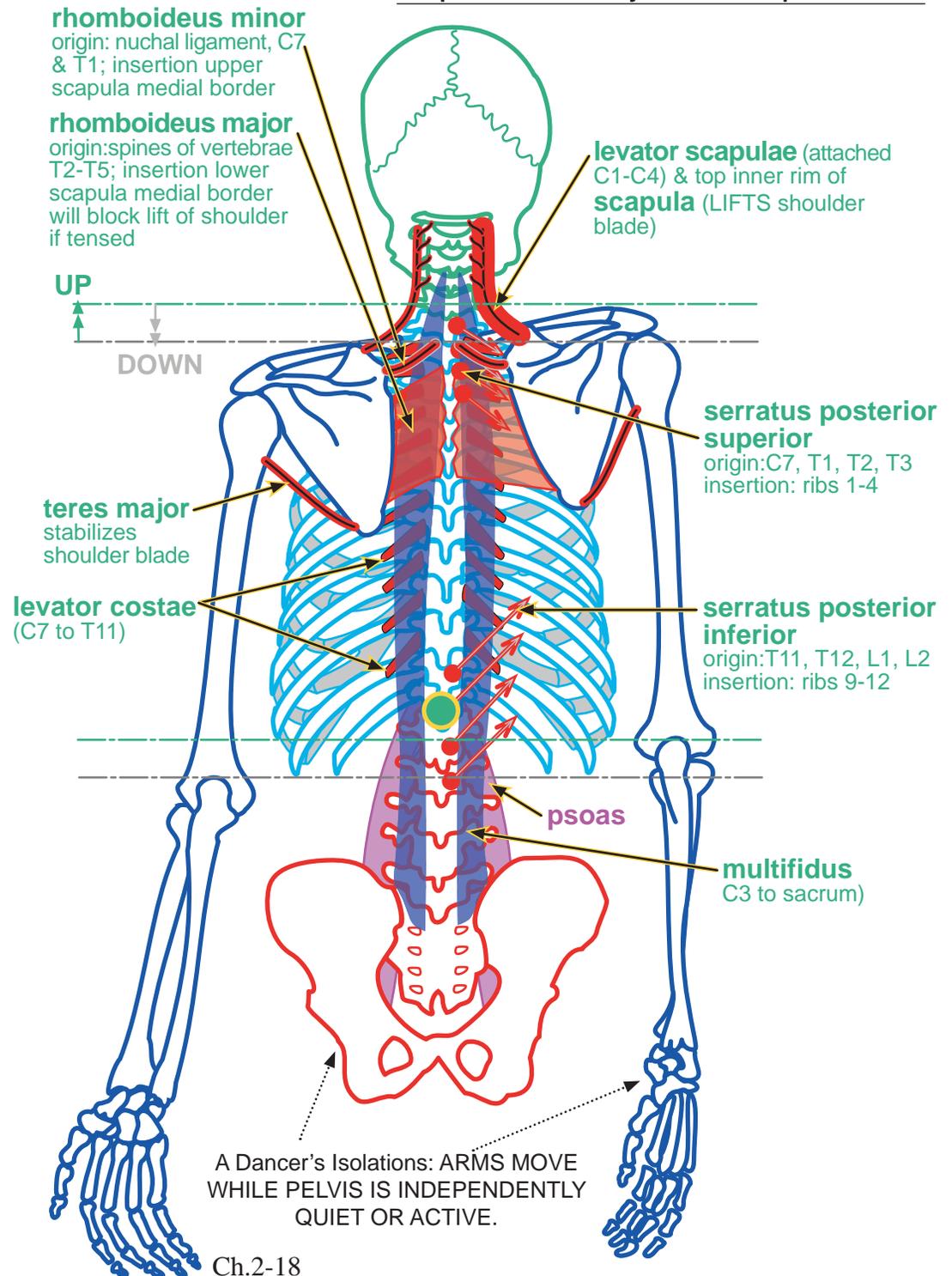
Some riders, when asked to “ride with a wide chest” will merely pull their shoulder blades closer. This is easily done by contracting the large rhomboides, a shallow muscle pair. **However, superficial muscular tension stops the smooth glide of the scapula on the upper back, an essential technique that isolates motions of the trunk and seat from the hands and rein.** Further, stiff muscles transmit shock waves from actions of the horse through the upper body.

Tensing neck muscles or clamping the jaw will also block smooth working of the shoulder blades.

Instead of tensing shallow muscles like the *rhomboides*, a rider may hold the trunk erect with major groups immediately along the spine (*multifidus* and *psaos* are part of those groups). Then the rib cage can be supported at its back by some of the deep muscles involved with respiration, among them the *levator costae*. Other respiratory muscles, especially the diaphragm, need to have freedom to function! In the intermediate layer, the *serratus posterior* muscles can be used to control the rib cage. *Serratus anterior* muscles that track along the ribs from the back under the arm to the front are not shown. Use of deep and intermediate muscles stabilizes the trunk as a foundation for support of **INDEPENDENT ACTIVITY** of arms and hands.

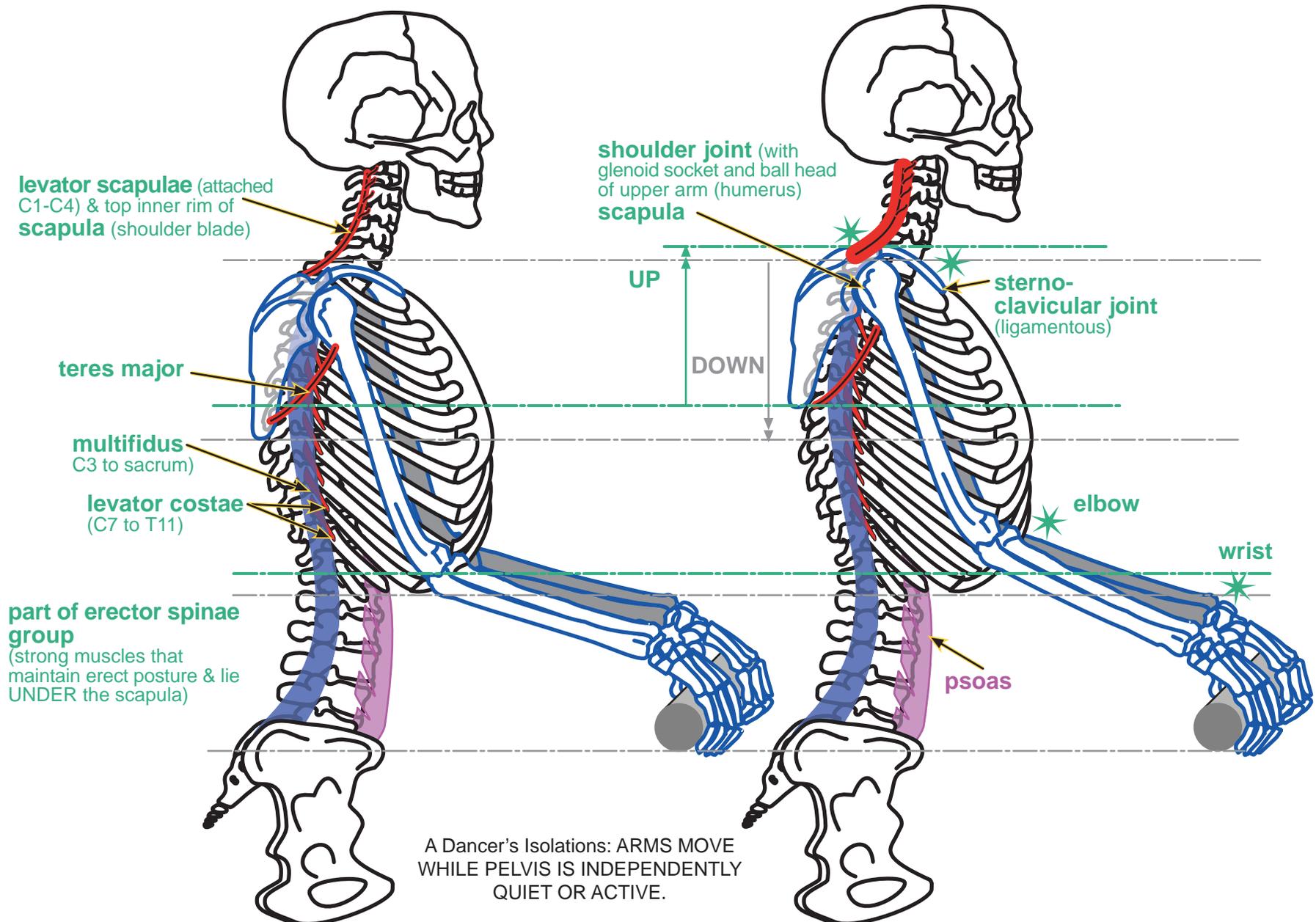
Serratus and *psaos* muscles divide some of the independent seat regions ABOVE the riding center of mass (green circle) from those BELOW the center of mass. THESE MUSCLES ALLOW BOTH COORDINATION AND **INDEPENDENT MOTIONS** OF THE UPPER AND LOWER BODY.

Multifidus and overlying *erector spinae* muscles (with their ligamentous sheaths) provide dynamically elastic stabilizing links between body regions. The foundation concept of relaxation goes beyond a narrow definition of “absence of energy” and embraces development of skilled use of specific muscle groups.



Selected Core Muscles of the Trunk: INDEPENDENT SEAT - 2

The Shoulder Shrug exercise using a ballet bar or table edge to steady hands can be very helpful in releasing tensions in the upper body. This is a complex exercise that moves wrist, elbow and shoulder joints to allow the shoulder blades (*scapulae*) to move while head, trunk and hands are still. Even though hands are flat, they are curled, showing that the extensors that stiffen elbows and arms are relaxed. This exercise may also be performed with the hands palm up. The palm up position keeps elbows close to the body, a desirable feature of the spiral seat.



The Independent Spiral Seat: How it Works 1

A kinesthetic key to the Spiral Seat is sensing where your center of mass should be to be in concord with the horse's center of mass. SEAT AIDS ARE GIVEN IN BALANCE WITH THE RIDER'S CENTER OF MASS ABOVE THE ACTIONS OF THE PELVIS. With inexperienced horses, feeling a rider in balance will help them learn to be balanced in relaxation and comfort. A relaxed rider is also able to avoid being swayed by movements of the horse.

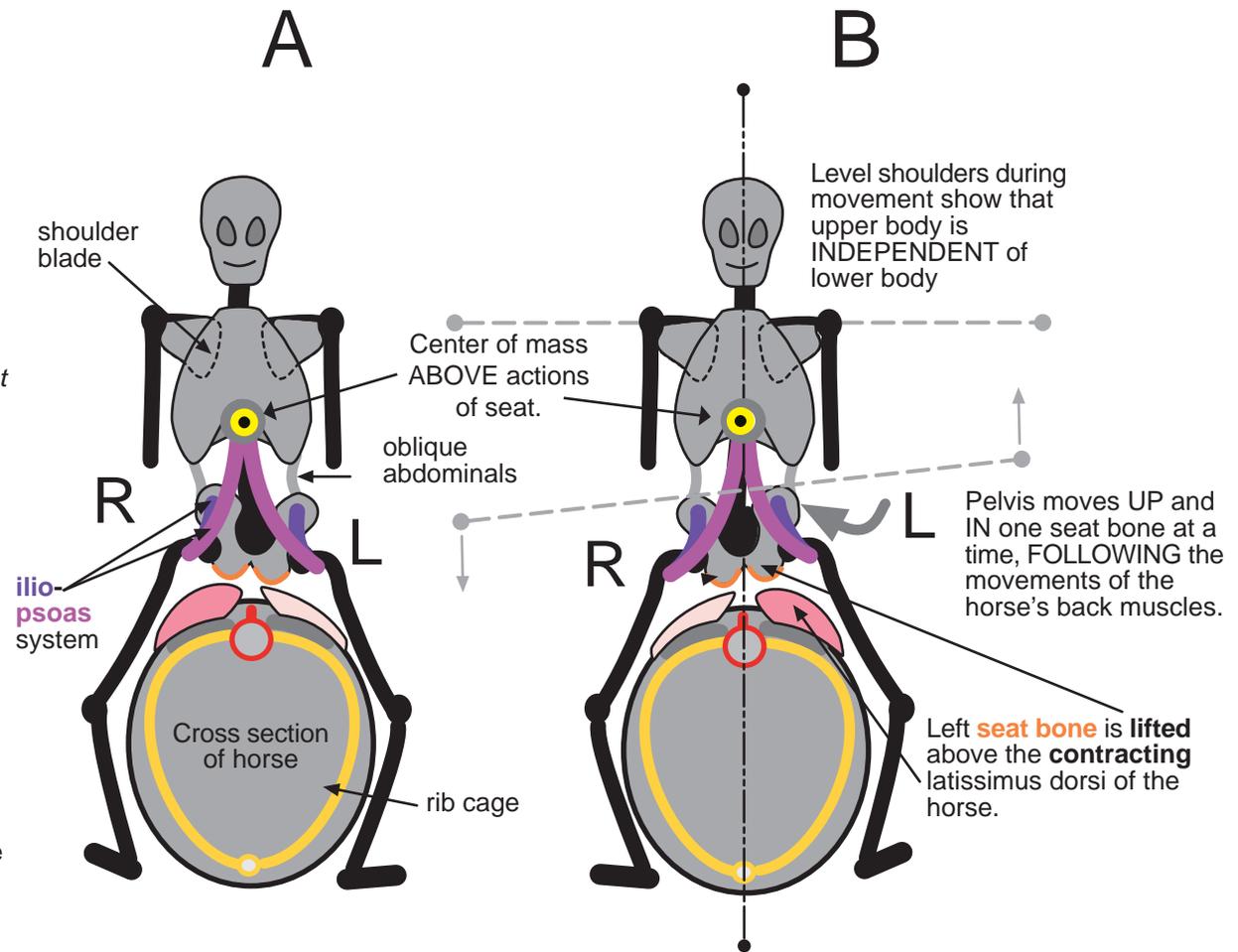
Communication with the horse using spiral seat half halts is primarily from lower body aids, with the upper body controlling center of mass and offering relaxed reception of the aids given by the lower body. Use of leg aids and degree of balance on stirrups is discussed in Chapter Three. We have not said much about the rider's head, but it is a ten to twelve pound weight and needs to be carried on a neck free of tension without tipping or flopping. Just as your horse should perform with a soft jaw, so should you. Clenching your jaw locks muscles of your neck, back and chest that need to be free to permit fluid, independent motion of your shoulders. Remember to breathe! You can stop your pelvis from moving effectively by holding your breath (and you need the oxygen for the muscular activity of riding).

Movements of your pelvis are accomplished by the ilio-psoas muscles deep in the body cavity (A) aided by external oblique abdominals near the surface. These muscles alternate the upward/inward motion of each seat bone half as the horse strides through its gaits. Because you sit on the diagonal sets of muscles (pink shaded) that are important movers of the horse's legs, your **motions are timed exactly with the pattern of the gait you ride**. Each half of the seat shifts slightly above the bulge of the contracting back muscle (A & B). Thigh muscles (not shown) also help control the pelvis and interact with the ilio-psoas system during riding. This use of overlapping riding muscles allows weight aids to be shifted by stretching one leg down into the stirrup. Avoid breaking at the waist to maintain effectiveness of weight aids.

Movements of the pelvis accomplished primarily with the ilio-psoas system of muscles works below your mounted center of mass, keeping it centered (the default position).

You are then prepared to *shift your weight aids in alignment*, to ask the horse to step in a specific direction. Maintaining aids aligned without tipping, tilting or rotating your torso (throwing a shoulder) are especially important for riding corners and circles. Many riders lose the relative position of shoulders and hips by twisting through corners, throwing the outside hip forward. This causes the horse to lose its straightness on the line or curve being navigated because it will imitate its rider's loss of alignment. Passing corners with the spiral seat is done with the outside hip slightly behind the inside hip, not just by shifting the lower leg back.

For lateral work, lifting of a hip lightly toward the direction of a movement with each stride is generally an aid the horse finds easy to "read."

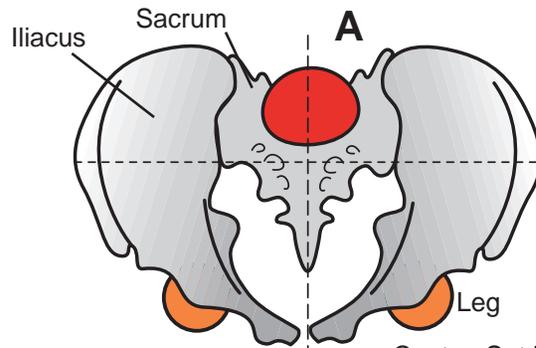


The Independent Spiral Seat: How it Works 2

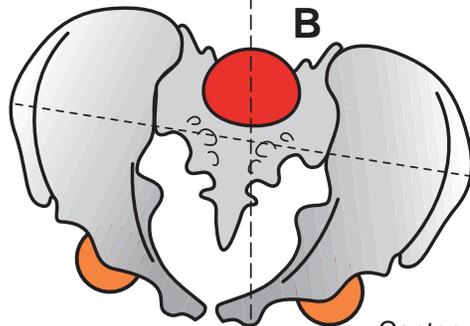
The platinum standards for the Spiral Seat are in two publications by the Schusdziarras (father and son medical doctors): *An Anatomy of Riding (Gymnasium des Reiters)* and *Reitergesprache: Der Weg zum unabhängigen Sitz (Conversations with Riders: The Way to An Independent Seat)*. The latter is not, to my knowledge, available yet in English translation. The authors are acutely aware of the need to communicate to the horse when to bend through corners or on circles, and when to ride in a straight line. Their examples are for the canter and are photographed for that gait. In my copy of *An Anatomy*, the two pictures are hard to evaluate, because riders are wearing jackets of nearly the same tone as the photo backgrounds. The text is very clear on the aids of upper and lower body. Photographs of high quality are in the second book, accompanied by more discussion of aids and with many of the diagrams from the first publication. Both books show the motions of the pelvis from the front, where lines of stick figures indicate bones.

I have developed the following computer illustrations of the positional aids. I thought it useful to view the spiral seat from above, as that is another perspective on the functional alignment of the upper and lower body. A and A' show bottom and top halves of the spiral seat with both legs and arms

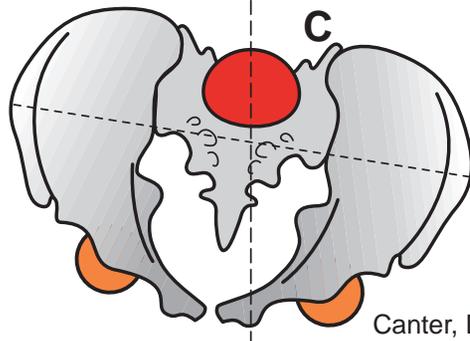
Pelvis, Top View



Canter, Set Up for Flying Changes

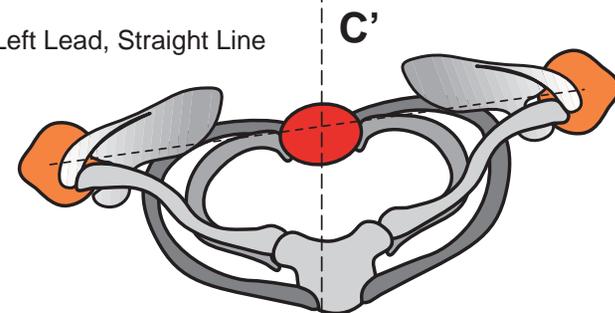
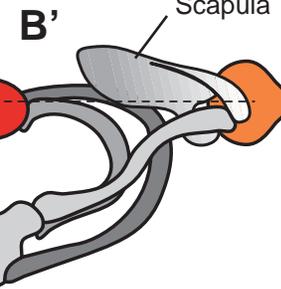
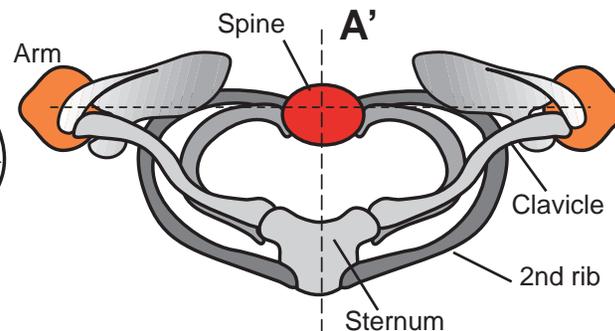


Canter, Left Lead, Straight Line



Canter, Left Lead, Corner

Shoulders, Top View



Ch.2-21

parallel. **Red** indicates the spine and **orange** indicates arms or legs.

For canter on Left Lead: B and B' show the "default setting" for riding straight lines, with the pelvis slightly offset, allowing the position of the inside leg to be at the girth and the outside leg to be behind the girth. This position facilitates freedom of the pelvis to follow the motions of the back (see Chapter 4 for the complex motions of a complete canter stride). As the Schusdziarras say, "The pelvis must sway elastically with the horse's movement even [or especially!] in this position." Lifts of the inside hip at each stride, activated by abdominal muscles and the deep iliopsoas system, maintain the canter. This slightly angled position and the activity of the inside leg at the girth are both the aid for the strike-off into canter and for maintaining the canter.

For canter on Left Lead: C and C' show passing through a corner. Oblique abdominals must relax just enough to permit rotation of the upper body so the inside shoulder is slightly back. The iliopsoas system maintains the action of the inside hip. Independent repositioning of the upper and lower body has two effects: it tells the horse that a bend is needed and assists in a slight degree of collection to help the inside hind of the diagonal pair to vstride through the corner. Slight rotation of the shoulders should not allow either shoulder to drop (breaking at the waist). Riders may wish to perform these independent motions of the upper and lower body unmounted in front of a mirror to get the *feel* of level spiral posture. To help those new to this position, it may be necessary to move the shoulders to the same angle as the pelvis, until the mid body girdle of muscles is supple enough to allow the fully spiraled position.

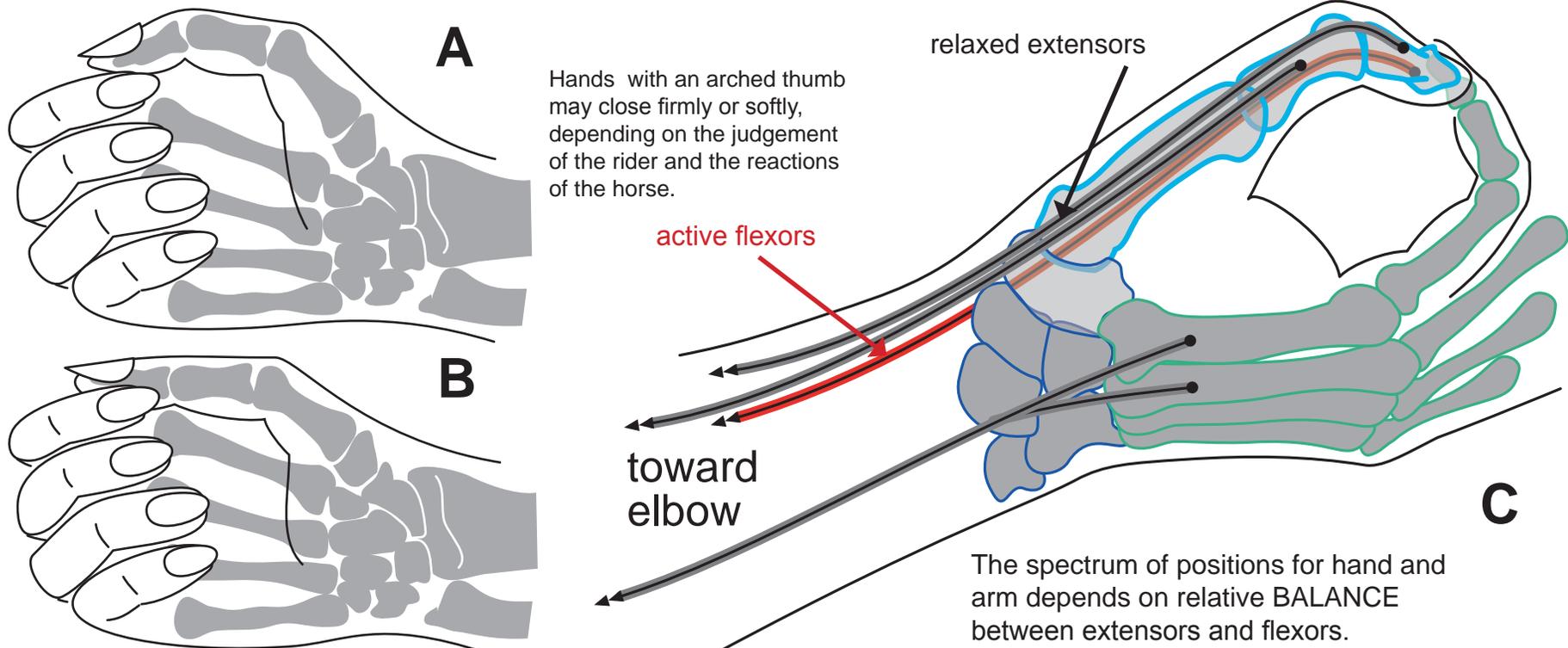
The Independent Spiral Seat: How it Works 3

Holding the reins is a topic covered in many ways in riding books. I offer here some brief strategic notes, with the hope they will be helpful to riders. They are intended to be an adjunct to material covered in other books. These notes also assume that riders will be using the spiral seat, the classic seat that emphasizes aids principally given in the lower body with a receiving upper body. While the movements of the hand are complex, it is worth discussing briefly some interesting effects on the wrist of holding the reins with the thumb either arched (A, C) or locked flat (B).

Nature has a clever arrangement for the controls of our hands. Muscles (ending in tendons which extend past the wrist into the hand) that EXTEND/open digits are on the back (dorsal) surface of hand and arm. Tendons that FLEX/close digits are on the palmar surface. The opposable thumb of our human hand works at right angles to the other digits. Locking the thumb down uses primarily superficial extensors in the forearm while arching the thumb relaxes extensors and activates flexors. These opposing controllers connect to arm bones in the region of the elbow.

WITH A CLOSED FIST, THE WRIST IS ABLE TO MOVE, EVEN WITH A FAIRLY STRONG GRASP, PROVIDED THE THUMB HAS EVEN A MOD-EST ARCH. A locked, flattened thumb (B) is the sign of a pulling hand and arm, using extensors that stiffen joints. Riders often open their hands, thinking that this softens the contact. However, tension of *arm* extensors behind that opened hand is transmitted to the shoulder and then to the seat while the rein slips away from a true elastic, consistent connection. With a securely closed fist and arched thumb, riders may adjust the contact without changing the length of the rein, merely by changing the degree of activity in the deep flexor muscles of the inner side of their arms. Bulging forearm extensors are a sign of a heavy, inelastic contact with the rein. It may help to think of the reins as helping or "instructing" the muscles of the horse's neck.

It is important to BALANCE muscular actions, because a rein may be held securely by the hand without risking pulling. In the case of the snaffle rein, this would mean the rein enters between the third and fourth fingers, crosses the palm and exits between the (arched) thumb and forefinger. Seen from the side, the wrist is straight with the thumb the highest point. From the top, the wrist is also straight. Upper arms hang down, with forearms making a smooth line to the bit in the default position. Holding the arms away from the sides (chicken wings), cocking wrists (piano hands, puppy paws), or spreading the hands beyond the width of the withers (serving turkey) are signs of tension. Widely held hands employ extensors that stiffen arms, actions ultimately felt in reduced mobility of the seat. The more relaxed the arm, the more it becomes part of the rein: "the hand belongs to the rein."



The Spiral Seat

The Spiral Seat is named for the spiral winding of muscle fibers and other connecting tissue tracts around the body. These work much like a “Chinese finger trap” to tighten when under tension, keeping the body from being pulled apart.

Of critical importance is the action of the internal **psaos and iliacus muscles** to move the pelvis alternately up-in and then back-down in a spiral motion that AVOIDS SHIFTING THE CENTER OF MASS RIGHT OR LEFT unless the change in position is a deliberate weight aid. This practice keeps weight aids precise and consistent in their meaning to the horse. It is not possible to overemphasize the importance of this controlled motion, as any random shift will alter the alignment of the rider's center of mass with respect to the horse's center of mass. Wiggly riding amounts to “noise” in the signals sent to the horse.

Keeping centers of mass between horse and rider correctly adjusted is the **KEY TO CORRECT LATERAL WORK, CORRECT CANTER LEADS, PIROUETTES and FLYING CHANGES**. For instance, if a rider carefully shifts the center of mass right, the horse will try to adjust its line of travel and come under the weight. Each type of lateral work, each canter lead and flying changes depend on the rider knowing how this sort of weight aid feels, how much to apply. Horses can be very clever about shifting their riders to a favored half of their backs in order to evade a response to the weight aids.

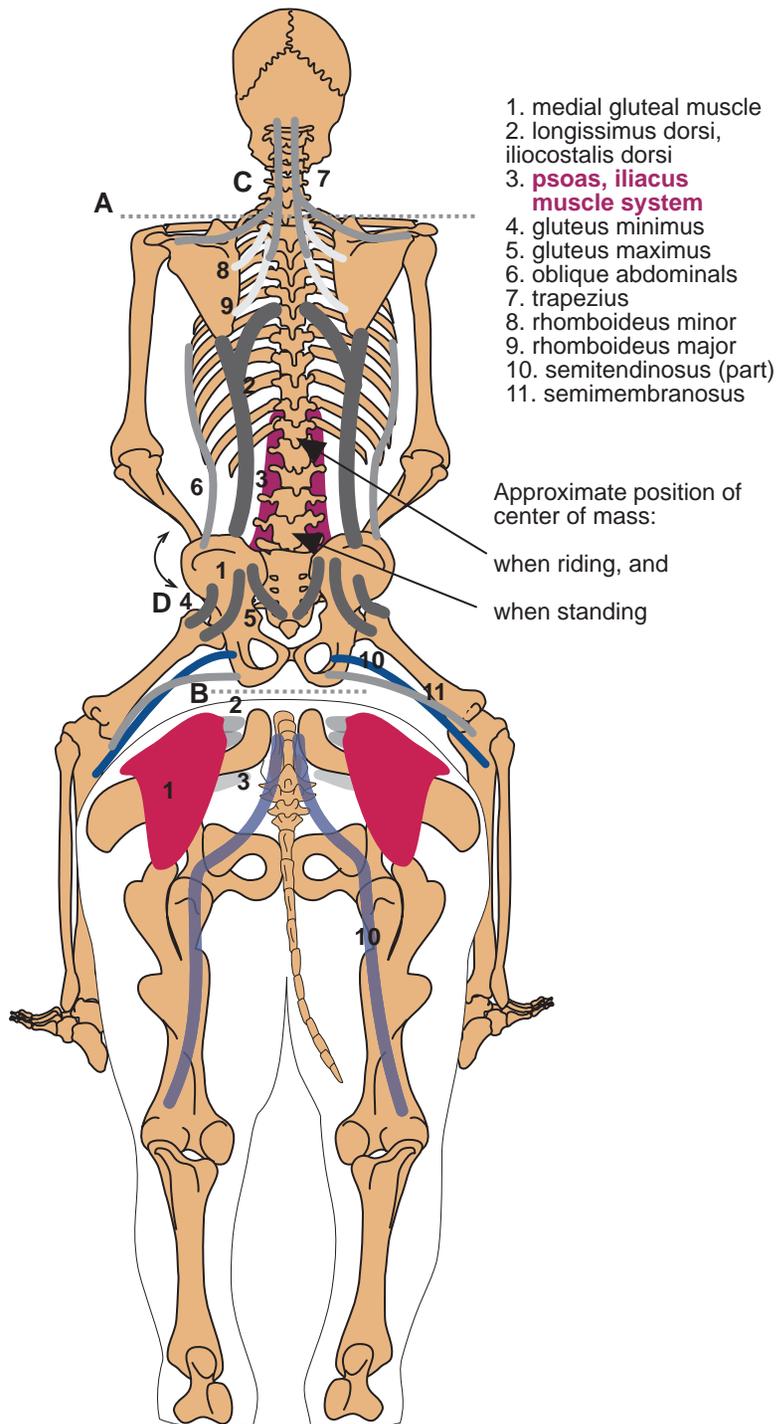
Stiffness in any part of the rider's body makes it easy for the horse to bounce the seat out of position. The need for athletic relaxation (flexibility, suppleness) extends to elbows, wrists, fingers. If all is relaxed and aligned, the Spiral Seat is the Classical Seat, where aids from the lower body manage the horse and the hands receive the effects of weight, seat and leg.

A) Shoulders are level and shoulder blades are kept free to slide softly across the upper back (KEY TO AN INDEPENDENT SEAT!). Freedom of hands and seat to act independently depends on relaxation of the *rhomboideus* and *trapezius* muscles. If the shoulder blades do not slide freely on the upper back, hands will bounce as the lower body is shifted by the movements of the horse's back.

B) Seat bones are level although weight is subtly distributed from one to the other for lateral work and bending, without breaking at the waist (usually accomplished by allowing more weight in the inside stirrup, or in the direction of movement),

C) Head, which weighs about 10 to 12 pounds, is carried without tilting right or left, neck is softly stretched upward. Riders should take care not to twist the neck or clench their jaws.

D) Seat and leg muscles, especially the gluteals and thighs, are relaxed in order to free the motion of the hip joint and pelvis to match the actions of the horse's back muscles. Give your thighs the “jiggle test” by seeing if you can shift the muscle mass easily over the thigh bone. If not, more relaxation is needed so only the sartorius riding muscles dominate leg actions. Feet should be balanced on their balls so they rest elastically on the stirrups.



The Spiral Seat: Problems With the Seat

Problems with the seat: "breaking at the waist."

A common habit of losing balance and straightness for the rider is called "breaking at the waist." It is usually seen when riders try to guide the horse along curved lines or in lateral work. It disturbs the seat because it

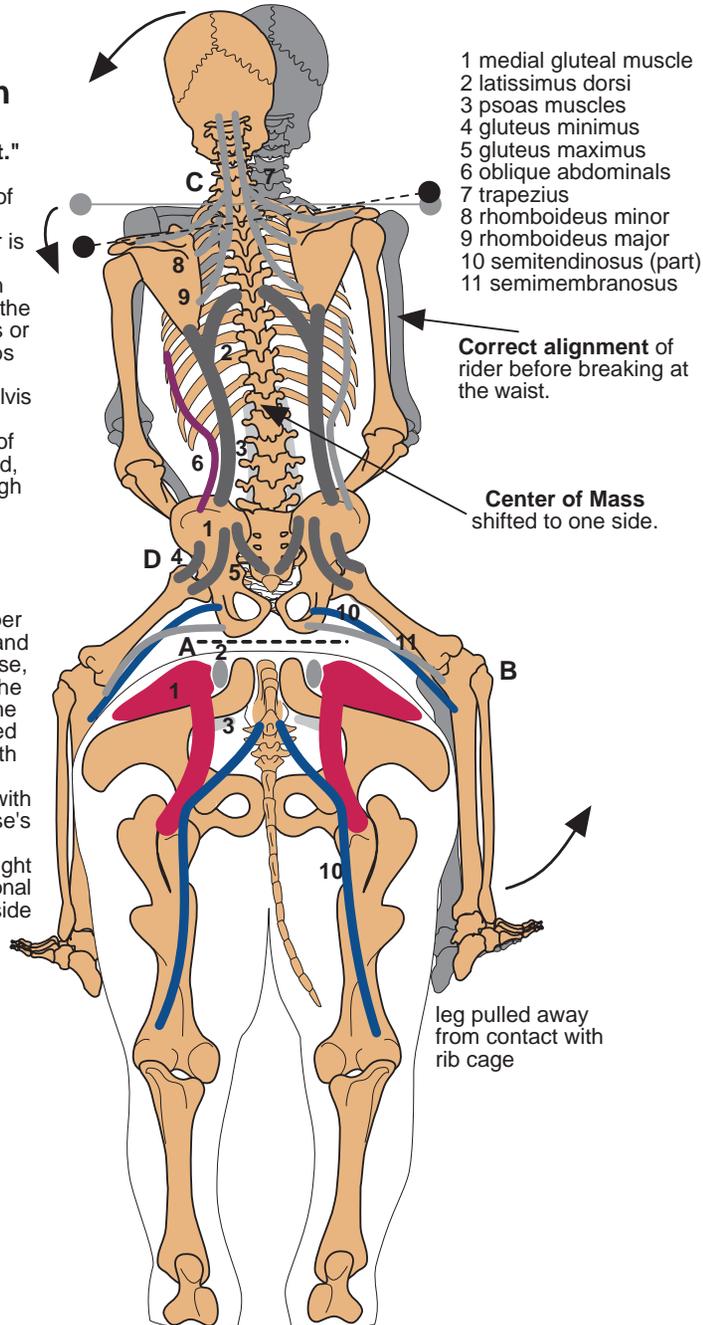
A) unevenly loads the pelvis to one side so that the subtle alternate "dance" of the spiral seat is disabled,

B) draws the leg and thigh away from the horse (usually the outside leg, shown here as the right leg),

C) produces uneven tension in the whole upper body, making the arms and hands more difficult to use,

D) produces tension in the muscles which control the hip joint of the overloaded seat bone, interfering with the mobility of the thigh, which in turn interferes with the operation of the horse's shoulder,

E) causes the rider's weight to interfere with the diagonal pair connected to the inside hind leg, the "prime" pair for carrying the combined mass of horse and rider through turns.



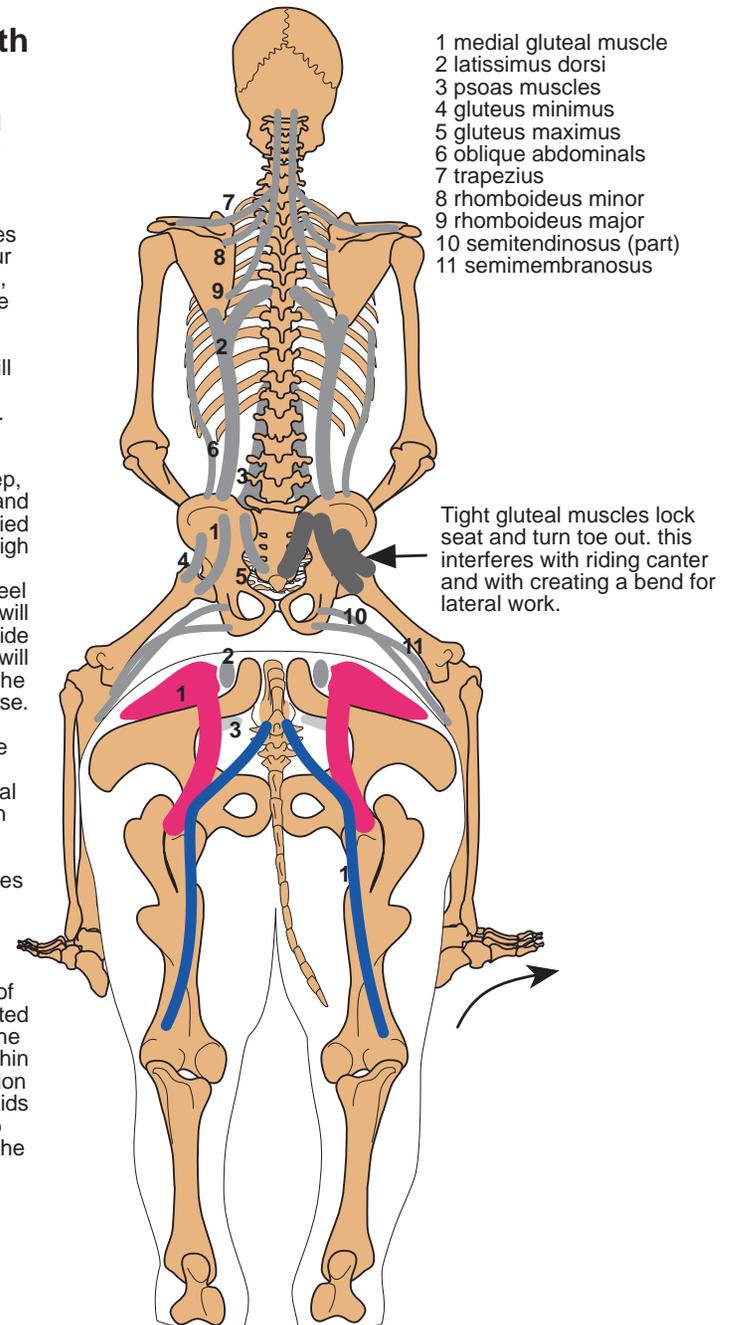
- 1 medial gluteal muscle
- 2 latissimus dorsi
- 3 psoas muscles
- 4 gluteus minimus
- 5 gluteus maximus
- 6 oblique abdominals
- 7 trapezius
- 8 rhomboideus minor
- 9 rhomboideus major
- 10 semitendinosus (part)
- 11 semimembranosus

Problems with the seat: "Toe Out" rider (contracted gluteal and inside of thigh muscles).

Contracting the gluteal set of muscles (1, 4, 5) will lock your pelvis to the sacrum, turn out the toe more than is normal for human leg conformation and will also restrict movement at the hip.

A tight seat interferes with a deep, relaxed lower body and is usually accompanied by tightened inner thigh muscles. As a consequence, the heel (here the right heel) will dig into the horse's side and the leg will be unable to follow the movement of the horse. The rider also risks injury to the leg if the toe is caught on a fence or other vertical piece of construction (ouch!).

Inner thigh muscles (grippers) are different from the riding muscles of the thigh (10,11). The riding muscles of the thigh are connected from the bottom of the pelvis to the upper shin bone and help position the pelvic bone for aids with the seat that go with the motions of the gaits.



- 1 medial gluteal muscle
- 2 latissimus dorsi
- 3 psoas muscles
- 4 gluteus minimus
- 5 gluteus maximus
- 6 oblique abdominals
- 7 trapezius
- 8 rhomboideus minor
- 9 rhomboideus major
- 10 semitendinosus (part)
- 11 semimembranosus

Spiral Seat Rider Position: Correlation with Access to Muscles of Trunk, Neck, Tongue and Jaw

Horse and rider are shown in an extended trot suspension with very slight uphill balance. All four feet are off the ground, but the hind leg of the LH-RF diagonal pair will land slightly ahead of the front leg (positive disassociation of the pair). Relaxed, balanced posture gives a rider harmony with latissimus dorsi and medial gluteal (pink shading) muscles that form a major cymatic (spirally aligned) group of the back.

Functionally, the Spiral Seat and its Classical Seat ancestor employ weight, seat and leg aids to communicate requests for performance to the horse's muscles and nervous system. Upper body aids are given independently of those from the lower body. Hands should be sensitively relaxed to receive the horse's response to the other aids. There is enormous "natural logic" underlying this seat: riding is "getting along with gravity." Further, a rider's lower body is the major connection to the horse, with the upper body subject to swaying if not flexibly controlled. Unsteadiness in the upper body shows up in an unsteady head and wobbly progress on lines and circles, precisely because the conjoined centers of gravity or mass are wagging.

A rider feels major back muscles act as they move the legs (a contracted muscle feels like a lump, which goes away when the muscle relaxes).

The ventral serrate muscles (dark blue shading) are available to a rider's lower leg to maintain the horse "on the aids. while hands receive the results of requests from rider's lower body.

The linkage between the ventral (thoracic or rib cage) part of the serrate muscle allows the rider's lower leg to influence the positioning of neck vertebrae via the cervical part of the serrate group. In turn, the intimate relations of the neck vertebrae to skull and tongue can be received by the rider's relaxed, INDEPENDENT upper body via the rein.

Connections between tongue and skull via the hyoid apparatus descend to the sternum (sternohyoid group in light blue shading) and overlap the deep caudal pectoral muscles.

The "shape" of this set of connections is like an "infinity" symbol and has been called the "circle of aids."

Illustration based on Riding Master Egon von Neindorff: "Brutality begins where skill ends." (private video collection of the author).

