

Meridians: Emergent Lines of Shape Control

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ABSTRACT

The Chinese concept of meridians has proved to be resistant to a bioscience understanding. Many investigative techniques and technologies have been applied to the human body in the search for a material substrate that is meridian-like. Using evolutionary biomechanics and embryology, the author has constructed a new model of human movement. The model, called 'Contractile Fields', has flexion/extension, side-bending, twisting, squeezing, limb, and visceral fields of contractility. That model was then turned towards the enigmatic meridians mapped over 2000 years ago in China. Recoil from a noxious stimulus is a reflex that all animals develop as a way of avoiding hurt. Acupuncture and moxibustion can elicit this reflex. Lines emerge on the body-wall and limbs that elicit similar biomechanical recoil vectors. The neurophysiology of recoil allied to the concept of 'border control' predicts 12 + 2 meridians as being the theoretical minimum needed to predictably control subtle human shape. Shape and function are closely coupled. Meridians are hypothesised to be 'emergent lines of shape control'.

KEYWORDS emergent, contractile fields, embryology, shape control, meridians.

Introduction

The practice of acupuncture within Traditional Chinese Medicine (TCM) is predicated on the existence of meridians. The map of meridians is the world's oldest medical map still in clinical use. The genesis of the map took hundreds of years and emerged from a culture that numbered 50 million over 2000 years ago. Gradually, medical anthropology is revealing the history of TCM, with new finds constantly adding depth to interpretation. The early Chinese medical theorists maintain that they mapped the movement of 'Blood and Qi'. Disturbance of Blood and Qi flow they saw as being the genesis of disease. This flow was condensed down to 12 + 2 tightly mapped conduits or meridians. With the influence of Western science in the 1900s, meridian mapping became anatomically referenced. A modern text, *A Manual of Acupuncture*,¹ runs to more than 600 pages of detailed description. Acupoints located on those meridians are needled in three-dimensional patterns called point prescriptions to treat disease. The practice of acupuncture is now a global phenomenon with well over two billion people having access to this form of treatment.

Bioscience has looked in vain for the meticulously mapped meridians. Dissective studies, CAT scans, MRI scans, PET

scans, thermal imaging, radioactive tagging, scanning electron microscopy, etc.; the full armamentarium of modern medical investigative techniques has failed to demonstrate a physical substrate that is meridian-like. There are hints of something afield (e.g. endogenous opiates and pain, some positive clinical outcomes), but to date, bioscience has been unable to fathom a contemporary understanding of the complex meridial map. The situation is analogous to the use of herbs before pharmacology – herbs 'worked', but how they did so was unknown.

The author suggests that the Chinese did indeed map a form of movement. An obvious movement, given the nature of needles and moxibustion, they mapped 'recoil from a noxious stimulus'. When you are pricked or burnt, you will move coherently and quickly away from the source of hurt. Recoil has a history that dates back to the pre-Cambrian animal diversification 540 million years ago (mya). The earliest life on this planet (600+ mya) was Edenic in that there is no evidence of predation – life was tethered or floated randomly. The pre-Cambrian period ushered in an explosion of new animal body plans,² including animals that moved volitionally with eyes and balance organs; predation with tooth, claw and sting became the way of the world. Teeth and recoil have a long evolutionary co-history –

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needles and moxibustion plug straight into this core survival reflex.

Interestingly, you are not born with a coherent recoil reflex. Rather, it takes years for the reflex to mature as the central nervous system (CNS) learns to map and control the moving body. A baby moves when hurt, but that movement is poorly co-ordinated. Maria Fitzgerald of University College London has studied the neurology of recoil in the human baby.³ Infants' nociceptive fields are larger, smeared in body image, more excitable, and noxious insult leaves a long-lasting deleterious CNS impression/facilitation, as the inhibitory neurons mature later. Babies and young children have yet to develop the accurate neuronal mirroring in the brain needed for effective recoil. The Chinese suggest babies do not have meridians (at this age the organs dominate); they emerge fully at the age of six or seven years. This is a crucial hint left by earlier Chinese medical theorists of the methodology they used to construct the meridial map.

There is an underlying pattern to recoil once it has matured as a reflex, and the Chinese mapped this pattern. Meridians are hypothesised to be 'emergent lines of shape control'. This deceptively important short phrase will take some contextualising.

The author wrote his fourth-year osteopathic thesis (British College of Osteopathic Medicine, 1983) on the subject of 'muscle chains'. If I get up from this chair and turn to greet you, I have just seamlessly employed hundreds of named muscles in a tight, temporal sequence. As my concepts matured over the years, I realised the most biologically valid way to explore muscle patterning would be via an appreciation of the evolutionary biomechanics of vertebrates, allied to the embryological development of the musculoskeletal system. Mammalian musculature is complexly patterned about a trilaminar body-wall with an overcoat of pectoral and pelvic muscle. Looking for primary movement patterns within that complexity led me to develop a new model of movement that is called the Contractile Field (CF): 'contractile' as it is a generic term rather than a tissue-specific term; 'fields', as opposed to 'chains' or 'trains', as there is nothing chain-like about how we move. 'Fields' and field theory offer a far more appropriate understanding of how muscle warps and wefts, dives and surfaces, braids and coalesces as it courses about the body. By the late 1990s, all the major building blocks of the CF model were in place when I then realised it could be used to shed a new light on the meridial map. This article will not detail the anatomy and biomechanics of CFs. At this stage it is enough to realise a blunt needle or a burn elicits a whole-body response. However, for a deeper understanding of this decoding hypothesis, further elucidation of the fields provides additional insight.

A Thought Experiment

Imagine you are standing upright and naked in a deep swimming pool. Your feet are weighted to the pool floor, your head is under the water, but a snorkel dispels any panic. An experimenter is able to prick any part of your body with a shark tooth – without warning.



FIGURE 1 Cartoon depicting a person, upright in water with a snorkel, pricked at CV12, shown in comic shock, flexing the body-wall and moving backwards away from the insult.

On the body-wall, pricking you ventrally will generally produce flexion and recoil away. Moving away from penetrative insult has obvious survival value. Pricking the side of your body will produce a side-bending ipsilaterally or contralaterally. A needle in the back will extend you and move you forwards. Lines emerge on the body-wall that, when stabbed with a tooth or needled with a 2000-year-old Chinese acupuncture needle (read, blunt), will initiate a similar movement vector.

Let's use the Conception Vessel (CV) channel (*Renmai*) to demonstrate and develop this idea. A needle to the midline of your abdomen will initiate flexion and recoil away, as seen when needling CV12, 11, 10, 9, 8 and 7. Then something interesting happens. Needling CV6 *Qihai* marks the beginning of a change in the recoil direction. Because of the lumbar curve in your back, you are now as likely to extend your pelvis as flex. By the time you are at the level of CV4 *Guanyuan*, it is definitely better to extend the pelvis to escape the penetrating insult, as flexion at CV4 will push your pelvis towards the needle.



FIGURE 2 Thought experiment comically depicting extension of the pelvis when CV4 is pricked.

The Chinese give great importance to areas of the body where movement fields invert. SP21 *Dabao*, an acupoint that is historically important, is another of these field inversion areas on the body-wall. On the lateral body-wall, a noxious stimulus below SP21 will initiate an ipsilateral side-bending, whereas above SP21, side-bending will be generally contralateral. Needling the lateral jaw will produce a side-bending ipsilaterally until the zygomatic arch, when contralateral side-bending is the face-saving thing to do.

Developing this model further: Imagine standing in the pool and being needled at CV12 *Zhongwan* – you would flex and move backwards away from the danger. What cannot be guaranteed with one needle applied to the midline is your drift to the left or right as you move backwards. That left–right drift arises from small initial conditions at the moment of impact, such as the direction of your gaze or a slight twist in your back. To be able to predictably flex and send you straight backwards, with no ‘ifs or buts’ the experimenter would need to use two needles, one on either side of CV12 *Zhongwan*, say KI19 *Yindu*. Now, using pressure that is more penetrative on the left or right needle, recoil away will be controlled. In effect, this is a form of ‘border control’.

Borders in biology – from the microscopic to the macroscopic – need two independent membranes in order to effectively control movement across domains. Earlier walls, which date to about 208 BC, preceded the Great Wall of China, so the Chinese were very border-conscious at a critical stage in the mapping of something we now call meridians.

The Leech

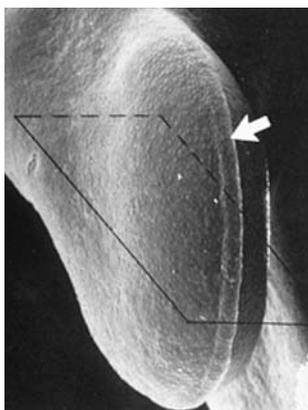
Bill Kirstan and John Lewis,⁴ using a leech as a model organism, have studied the neurophysiology of recoil. This work is essential to a modern understanding of acupuncture. The leech was chosen as a model organism as it has only 40 sensory neurons distributed around the body-wall. A pinprick that elicits recoil will usually fire two sensory neurons, these feed down to interneurons that summate the available data and inform the motor neurons to move the appropriate part of the body-wall away. What Kirstan and Lewis discovered was the mathematical ability of the interneuronal layer. These nerve cells can add, subtract, compute sines and cosines, and manipulate trigonometric identities that would challenge a 15 year old with a calculator. As any leech knows, $\cos(\phi-\theta)$! Kristin and Lewis suspect all higher organisms use overlapping sensory fields and an almost hard-wired sense of trigonometry to avoid penetrative insult.

How many emergent lines of shape control are needed to predictably control subtle human shape (morphology)? Borders will need to be identified and then controlled using meridians on either side of that border. The CF model identifies primary (mammalian) movement fields as: flexion/extension, side-bending, twisting left or right, squeezing/sucking, and limb fields. Each field borders other fields and the fields are profoundly interactive. Based on this analysis:

- The Dorsal and Ventral midline. Vertebrates are bilaterally symmetrical and so the midline is mandatory. (Conception Vessel and Governor Vessel channels)
- Bilateral/paraxial lines of border control of both the dorsal and ventral midline. (Inner Bladder channel and the Kidney channel)
- The lateral body-wall has an indistinct ventral/dorsal border. To control laterality, criss-crossed lines need to be placed near the dorsal and ventral margins of the lateral Contractile Field. (Gallbladder and Liver channels)
- Helical biomechanics are introduced when you needle intermediate lines on the body-wall, as helical biomechanics are a compound of flexion/extension and left–right side-bending. Rib angles on the thorax and the lateral raphe of the thoracolumbar region mark the intermediate dorsal body-wall; on the ventral body-wall the linea-semilunaris and the costochondral junction mark the intermediate line. (Lateral Bladder channel and the Spleen channel)
- Biomechanically, 14 lines will control a mammalian body-wall. The model predicts the dorsal and ventral midline as two lines, four para-axial lines to control the midline, four lines to control the lateral body-wall, and four lines that are intermediately placed to initiate helical movement. However, if you count around the torso, the Chinese map 16 meridians. The Chinese medical theorists recognised the importance of the nipple-line and the need

for its representation. Breasts and suckling lips are unique mammalian attributes; the bottom line – without a wet-nurse you starved. Embryologically, the nipple-line, in its early embryonic period, was intermediate in its placement on the body-wall,⁵ near the SP meridian. During subsequent development, the arms rotate laterally and the legs rotate internally, pulling the skin and the nipple-line. (Stomach channel)

- Limbs: The embryonic limb bud is paddle-shaped and is described as having a pre-axial border (thumb side), a post-axial border (little-finger side), and ventral/dorsal axial lines that mark the midline of the limb bud (Fig. 3).⁶ Limbs are derived from fins.⁷ Fins are optimally placed on the body-wall of a fish to control pitch, yaw and roll. Small movements of a fin create large changes in direction. Vertebrate limbs became stout and propulsive, but in essence still control movement.



A limb bud with the dorsal axial line (SJ) marked as a solid line, the ventral axial line (PC) as a dashed line. The pre-axial border is controlled by the Large Intestine (LI) and Lung (LU) meridians; the post-axial border is controlled by the Heart (HT) and Small Intestine (SI) meridians.

The Apical Ectodermal Ridge (AER) is arrowed, a local summit of the whole embryo-encircling Wolffian ridge. Limbs, derived from fins, steer movement.

FIGURE 3 Limb bud at 32 days (from Larson⁶).

In theory, six lines are needed to control the limb-bud shape. Two lines are needed to control the leading edge of the limb bud, i.e. the pre-axial border (LU and LI/SP and ST); two lines to control the post-axial border (HT and SI/KI and BL); and two lines to mark the ventral/dorsal midline (PC and TE/LR and GB). These six lines allow accurate shape control of the limb bud. The importance of accurate limb-shape control is analogous to the control of an aeroplane's wing flap. Small changes at critical places in a system initiate large responses.

The Chinese must have pondered long and hard about how they could map the obvious similarities and the profound differences they found between arms and legs. Embryologically, the lower limb has a long-axis twist to it that the upper limb bud does not experience. Due to the internal rotation and long-axis twist of the lower limb, the quadriceps of the leg is analogous to the triceps of the arm. Note how the Chinese have placed the Stomach (ST) meridian, a Yang meridian, on the ventral surface of the body. The crossing of the leg Yin meridians at SP6 *Sanyinjiao*, the crossing of the Bladder (BL) meridian behind the knee and the crossing of the Stomach

(ST) meridian at the hip joint, all suggest this attempt to map the long-axis rotation of the leg.

The decoding hypothesis presented here makes sense of much of the arcane information packaged with meridians, for example, the internal/external relationship. Meridians are coupled across borders because both are needed to control the border. One without the other is like a car only able to turn to the left. Six-channel pairing is the simple similarity between, for example, a ventral pre-axial border on the arm (thumb) being analogous to a ventral pre-axial border of the leg (big toe). Deep channels are fascinating. Meridians are depicted as being left/right and only at the mouth and genitals are the 12 meridians routinely depicted as being crossed. Contractile Field (CF) modelling leads one to consider where muscles decussate (cross) as they form the warp and weft of the body's musculature. Meridians, via the deep channels, are comprehensively decussed across the midline, particularly the ventral midline.

Shape Control

Meridians are emergent from a whole living organism that is able to react coherently to a noxious stimulus. When an organism is too tired (Qi deficient), the meridians will evaporate. No energy, no recoil. At death meridians depart; they will not be found in a cadaver. They are not a distinct biological tissue and this is why they have proved to be so elusive to bioscience. Meridians, it is proposed, allow subtle shape to be predictably manipulated. From this perspective, acupoint combinations to treat clinical syndromes are a form of three-dimensional shape manipulation. Shape and physiological function are closely coupled.

Acknowledgments

Figure 3 is reprinted from *Human Embryology*, WJ Larson, p. 284, copyright 1993, with permission from Elsevier.

References

1. Deadman P, Al-Khafaji M, Baker K. A manual of acupuncture. East Sussex, UK: The Journal of Chinese Medicine Publications; 1998.
2. Raff RA. The shape of life: genes, development, and the evolution of animal form. Chicago: University of Chicago Press; 1996.
3. Fitzgerald M. The birth of pain. Medical Research Council, Summer 1998, No. 78.
4. Howlett R. Simple minds. *New Scientist* 1998;185(2139):28–32.
5. Carlson BM, editor. *Human embryology and developmental biology*. St Louis: Mosby; 1994.
6. O'Rahilly RR, Müller F. *Human embryology and teratology*. 2nd ed. New York: Wiley-Liss; 1996.
7. Liem KF, Bemis WE, Walker WF, Grande L. *Functional anatomy of the vertebrates: an evolutionary perspective*. 3rd ed. Orlando, FL: Harcourt; 2001.
8. Larsen WJ. *Human embryology*. New York: Churchill Livingstone; 1993.