Fascial restriction and the cycle of physical decline perpetuated by our modern lifestyle.
by Michelle Blore

The aim of this essay is firstly to provide an introduction to the structure and function of fascia, and its effects on musculo-skeletal function, before going on to examine its potential influence on that general 'malaise' of modern times, the feelings of tension, anxiety, listlessness and increased susceptibility to illness that lead us to describe ourselves as 'stressed-out', including the manifestation of more serious physical symptoms such as shortness of breath, chest pain and palpitations which may result specifically from related breathing dysfunction.

Fascia is a densely woven connective tissue containing closely packed bundles of collagen fibres within a gelatinous ground substance that is the internal and external environment of every cell in the body. The fibres are arranged in a wavy pattern parallel to the direction of pull exerted on the tissue fibres by internal and external forces, such as posture, weight gain and mechanical injury. It surrounds and penetrates muscles, blood vessels and nerves, as well as all our internal organs including the heart, lungs, brain and spinal cord. Superficial fascia is found in the subcutis in most regions of the body, blending with the reticular layer of the dermis; deep fascia interpenetrates and surrounds muscles (e.g. the perimysium), bones and blood vessels; visceral fascia suspends the organs within their cavities and wraps them in layers of connective tissue (e.g. the pericardium of the heart). However, these layers are not discrete, but one continuous structure with no beginning or end, flowing through the body in a three-dimensional web without interruption. As such, its comparison to the yarn of a sweater is justifiable.

Fascia coexists with and determines the integrity of every muscle in the body, from the epimysium that wraps around the whole muscle, down to the sarcolemma of each individual muscle cell. An understanding of the embryological development of fascia is a useful foundation to appreciating its structure and function. Primitive organ growth is reliant upon a mesodermal intracellular matrix; for example, a specific 'potential' organ such as the pancreas will only develop into a mature organ in the specific presence of 'primitive' potential fascia. It has been suggested that primitive fascia creates a 'specific energy field' in which the cells of the organ mature and differentiate (Schultz 1996). The bones of the limbs start as buds which move rapidly away from the trunk, drawing the myofascial tissues into strings parallel to the bones and developing stress and strain lines, some of which form into ligaments and tendons. Schultz suggests that clumps of 'potential' muscle caught within this directional pull, differentiates into mature muscle which then elongates through directional pressure. This helps to explain why muscular action is interconnected and why restrictions, postural defects and injuries in one area can manifest such detrimental effects elsewhere in the body.

As fascia surrounds and attaches to all body structures one of its key roles is that of support. In addition, the established function of myofascia in particular is to reduce friction, allowing muscles to glide easily over each other, thus minimising energy waste and enabling the individual elements of major muscle groups to function in a balanced and optimal way. However, recent research indicates the presence of a micro-fascial system of hollow tubules within every cell, through which fluid flows. Some theories suggest that energy, information and consciousness flow within this fluid, which as well as transporting oxygen, nutrients and chemicals around the body also transmits energy and information throughout our entire being. In other words, it is suggested that fascia functions as a sort of 'fibre-optic' cabling system, operating at much higher speed than the neural pathways currently recognised by modern medicine. Indeed, given that neurones transmit signals at just over twenty meters per second it seems impossible for conventional neural pathways to stimulate the trillions of cells in our bodies that have over one hundred thousand reactions per second. The presence of large quantities of melanin in fascia appears to support this theory, as melanin has superior conducting properties at room temperature. It is synthesised by mast cells, also found in fascia, and neuromelanin present in the neural structures and the brain may be involved in regulating the firing of neurones. Certainly, piezo-electric behaviour has already been established as an inherent property of bone and other connective tissues, and it is suggested that compressional stress creates minute quantities of electrical current flow. It may be that fascia's ability to conduct bioelectricity in this way is linked to the

theory of acupuncture 'meridians' and the bio-energetic lines described as flowing through the body by ancient Chinese medicine, which it is thought in turn may be linked to the stress lines found in fascia.

Returning to the established scientific understanding of the structure and function of fascia, it becomes relatively easy to appreciate how fascial restrictions in random strain patterns can shorten, creating abnormal tensions and compressive forces upon neural, osseous and vascular structures, and ultimately resulting in dysfunction and pain. Physical or emotional trauma, postural defects, repetitive stress, inflammation and/or surgical procedures reduce fascia's pliability, creating myofascial restrictions that can produce tensile pressures of around 2,000 pounds per square inch on pain sensitive structures that do not show up in many standard tests such as x-rays, CAT scans and electromyography. The fluidity of the fascial system is compromised as part of this reaction; it becomes dehydrated and begins to solidify, and over time this hardening tends to deepen and spread. It is thought that a high percentage of people suffering with pain and/or reduced mobility may have fascial problems, but most go undiagnosed. Fascial restrictions affect flexibility and stability, as well as being a determining factor in our ability to withstand stress and perform daily activities with ease. Just a 10% change in water content can trigger a million-fold change in charge transportation along a protein, so if fascia really does form a key part of the body's information and energy communication system, one can extrapolate how the feelings we describe as being 'listless', 'low on energy' and 'out of balance' might arise.

Dr Peter Levine has developed an intriguing model concerning the primitive responses of both animals and humans to psychological and physical stress: at times when neither the 'flight or fight' response will ensure safety, a third line of defence – that of 'freeze' – comes into effect. This state of shock and immobility is beyond conscious control and becomes a vicious cycle, maintaining high levels of physiological activity in both the sympathetic and parasympathetic nervous systems. Whereas animals come out of this state quite naturally once the threat has passed, discharging a huge amount of energy in the form of shaking, profuse sweating and deep breathing in the process, humans are unable to resolve the situation so easily because the supercharged energy within their nervous system is imprisoned by emotions of fear and trauma. This results in chronic immobility and the associated restrictions and compensations. Levine postulates that manual myofascial release techniques facilitate the completion of this cycle by altering the habitual muscular holding patterns, eliminating gravity and thus unloading the body's structure in order to allow the righting reflexes and protective responses to temporarily suspend their influence, in turn releasing the instinctual 'freeze' response.

This may be a reaction to a specific, intense experience such as a life or death situation. However, one can also imagine how consistent lower levels of stress could over time result in a similar reaction. Whilst today we are unlikely to come across the former scenario, the latter is an increasingly common feature of modern living which, because we are habituated to it, is harder to identify and potentially even more difficult to exit. In addition to the sedentary, repetitive nature of our lifestyle and our deteriorating diet, this contributes to the body's myofascial framework adapting to a 'holding pattern'. As the muscles weaken due to inactivity, they lose their ability to support the body and the fascia increasingly takes over this role, thickening and tightening in order to work against the effects of gravity, which intensify as posture becomes steadily more misaligned. Some muscles may lengthen and weaken, whilst others shorten; for example in the case of the office worker sitting at their computer for prolonged periods of time. At the same time, looking for rapid energy boosts we snack on foods with high sugar content, but excess blood glucose is ultimately converted into harmful free radicals that can degrade collagen (Gillery et al 1996), the very substance of fascia, leading to further loss of elasticity and function. Eventually, normal muscle function begins to fail and the body's neurological system begins to overcompensate for muscle weakness, overloading and over stimulating the motor end plates, leading to the development of trigger points, or localised spots of 'exquisite pain' that are tender to pressure and cause referred pain. They may be implicated in all types of musculo-skeletal and mechanical muscular pain and develop in the myofascia mainly in the centre of the muscle belly, as well as at satellite points which are often situated along fascial lines of stress. Based on Shultz's 'specific energy field' theory, it has been speculated that such trigger points develop along lines of altered energetic activity or altered strain patterns.

A further complication in this cycle of stress, anxiety and increasing fascial restriction is its effect on breathing and the circulatory system, which reduces the amount of oxygen available for the very production of energy itself. For example, modifications in posture directly alter the fascia which envelopes, supports and gives coherence to the soft tissues of the breathing mechanism (Myers, 1997). Even slight changes in breathing can produce significant physiological, structural and functional effects due to the resulting changes in blood chemistry. Postural misalignment, restrictions and stress or anxiety can all cause a shift to a sub-optimal breathing pattern, which is largely through the mouth, high-chest, shallow and rapid. Whilst this maintains or increases the amount of oxygen coming into the lungs it also reduces the amount of carbon dioxide in the blood (hypocapnia) making it more alkaline and reducing the ability of haemoglobin to release oxygen to the tissues (the Bohr Effect). The respiratory control centre in the brain detects this alkalosis and re-sets at this level, increasing the respiratory drive and further perpetuating this type of breathing. At the same time the sympathetic nervous system is engaged, initiating vasoconstriction and decreasing blood flow to the vital organs – the 'fright or flight' response once again. So, no matter how much oxygen is taken in, the body experiences a shortage, causing ischaemia, fatigue and pain, as well as being implicated in the evolution of myofascial trigger points. It has been suggested by Chaitlow (2002) that hypocapnia also increases fascial tone, thus perpetuating the cycle. For many people, poor breathing habits simply contribute to sensations of a lack of energy and tiredness, but in more serious cases symptoms may include breathlessness, chest pain, dizziness, palpitations and pseudo-angina. However, sufferers often undergo multiple medical tests which fail to detect any abnormality or establish a diagnosis.

Chronic stress and anxiety, inactivity, poor dietary habits and postural dysfunction: given their effects on fascia, we should not be surprised that unexplained muscular pain, reduced physical function and mobility, muscular weakness and lack of energy are frequent complaints of western society today. We are stressed by overcrowding and the relentlessly increasing pace of life, made anxious by the threat of unemployment, our lives are physically undemanding and we lack the time to exercise, whilst at the same time we acquire postural defects by sitting in an office, working at machinery or spending long hours driving. Ultimately, even our breathing may be compromised. The external restrictions of our lifestyle are transferred to internal ones in a vicious cycle of adaptation as we live in an environment that our bodies are unsuited to, and as a result the very tissue which guides our embryological development may ultimately lead to our physical decline.

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