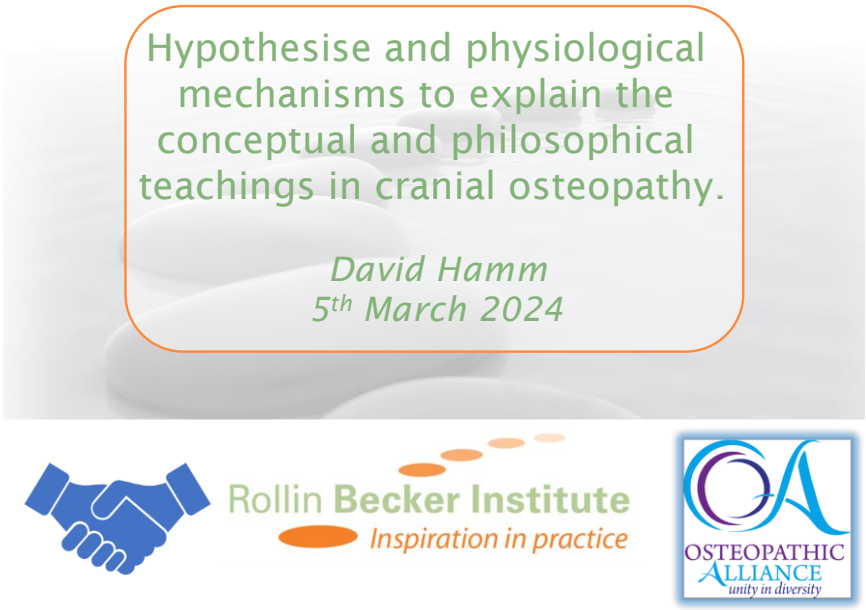


My name is David Hamm and I am here tonight representing the Rollin Becker institute.

I want to talk to you about some of the science, hypothesise and ideas that I have found out about that has helped me to start to understand some of the philosophy underpinning the explanation of osteopathy in the cranial field. OCF is talked about in philosophical ways and the science has helped me to explain what I am doing when I use the cranial approach.

I qualified at the British School of osteopathy, B.S.O, in 1990 and have worked in private practice in Newbury, from home and Hungerford, in a G.P. practice since. I became interested in Cranial Osteopathy and attended my first course in 1992 run by Nick Woodhead at the B.S.O and having completed the courses over the following 6 years he gave me the opportunity to start teaching, first at an undergraduate level tutoring at the tables and then I built up to undergraduate lecturing and then to postgraduate teaching. The college had just moved into this building by then. (The B.S.O moved from Suffolk Street to Borough high street around 1997/8)

It was around 2005 that Nick set up the Rollin Becker Institute. A group of us keen to promote the teaching of Cranial Osteopathy as conceived by Dr Sutherland and the teaching and ideas of Dr Rollin Becker. https://rollinbeckerinstitute.co.uk/. He adapted his 'listening approach to work more on the fascias of the body with a more compressive approach.

Today, the Rollin Becker Institute is part of the osteopathic alliance. I imagine you all know more about that organisation than me but they have been set up to represent special interest groups within the profession and to ensures osteopathic philosophy, principles and scope of practice are fully preserved, maintaining the breadth of practice whilst remaining current & relevant.

I completed a post graduate qualification in OCF in 2005 but it left me with an itch. An itch I had to scratch. In essence it came down to students asking, 'what are we doing?', 'What is happening when we treat?' and I if I was honest didn't know. I'm not sure I really know now but I decided to start to try and look for some answers.

I wanted to look at it from a clinical perspective I trusted what I was feeling under my hands but there was no literature to be found. I thought I would start looking for physiology.

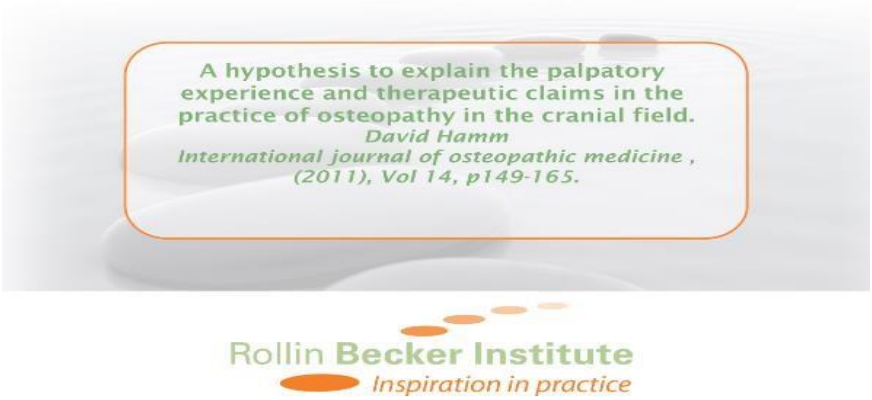
I knew that you contacted the head, or other parts of the body, and you tuned into the involuntary mechanism, IM, if you were lucky and there was enough vitality the body responded and the mechanism started to slow, comes to a stop resulting in a still point, after a few seconds or so there was a wobble and the IM slowly starts back up and returns. Usually you feel a difference, there was an improved quality to the IM, better amplitude and more drive.

What has happened in this process and what has changed? Can we explain what has changed and how can we claim that change has constituted a therapeutic change?

After a few years of teaching, I realised there was very little information or research that explained what was actually happening under my hands as an OCF practitioner. Nothing explained what I was doing and feeling. I realised that if this was going to change then I had to start looking for reasons. I started looking in the literature for some sort of explanation and realised there weren't any. The explanation had to be scientific and physiologic, it had to explain the feelings that I felt before, during and after treatment, they had to offer some form of rationale to the perceived benefit felt by patients after treatment but had to stand up to rigorous scrutiny and known physiology and science. Any hypothesis offered had to be balanced and reasoned. I started looking at the philosophy and tried to find if there was any science to explain the concepts of that palpatory phenomenon. It took a long time but slowly evidence started to present itself that offered the possibility of an explanation. An explanation was there in looking at the physiological properties of collagen and how these properties changed by the application of compression. Just as Dr Becker taught. The changes in these properties lead to other physiological phenomenon that explained the conceptual idea of the still point and the perceived change in the quality of the tissues. A scientific reason manifested to help explain Dr Still and Dr Sutherland's philosophical teachings and conceptual ideas.

This has an obvious benefit to UK osteopaths fighting for recognition and in the age of evidenced based medicine and the possible demise of osteopathy in the cranial field. Something which has actually become all too real! A reasoned scientific and physiological hypothesis that might explain what is happening with hands on treatment and explain possible clinical benefits could be, with time researched and validated.

That was my starting point and a few years later my thoughts and findings were published in IJOM – titled:

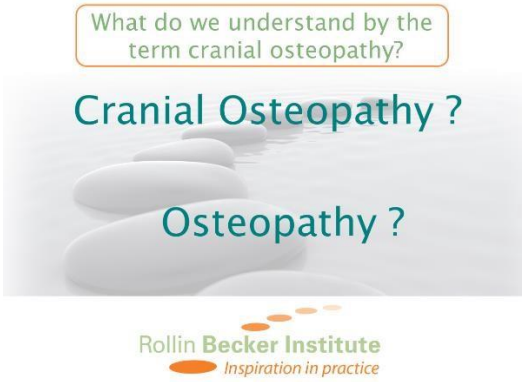


'A hypothesis to explain the palpatory experience and therapeutic claims in the practice of osteopathy in the cranial field' it appeared in IJOM Vol 14 in 2011 p149-165,

The published version was version 21, It is very 'papery' and difficult to read. Since then, I have been breaking it down to make it more readable. I am only suggesting these ideas, they aren't proven or fact or a belief system. The physiology is well known and talked about.

This material still needs to be subjected to 'honest questioning'. To that end if you have any thoughts, please let me know. Email me on davidrhamm@virginmedia.com.

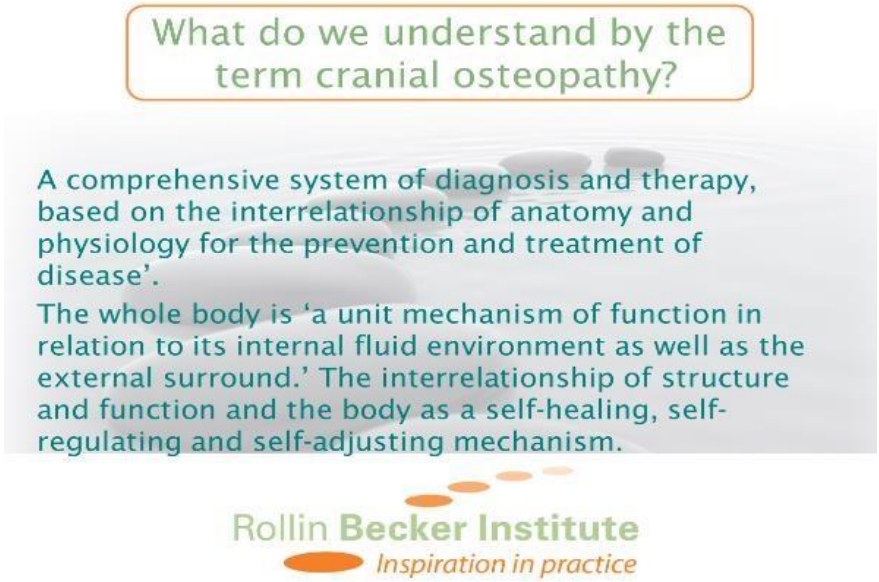
If you have any questions, please do not hesitate to stick your hand up and ask, from experience if one of you is struggling, someone else will be struggling, you all know each other, so don't feel embarrassed to ask, we have all struggled or are struggling with the same issues. I am not promising I will know the answer!



Let me start by asking you what you believe Cranial Osteopathy to be?

What do you understand Osteopathy to be, what is its definition?

What is the definition of Osteopathy?



Dr Still defined it as: 'A comprehensive system of diagnosis and therapy, based on the interrelationship of anatomy and physiology for the prevention and treatment of disease'.

It was based on Dr Andrew Taylor Still's three core principles:

1) The whole body is 'a unit mechanism of function in relation to its internal fluid environment as well as the external surround.'
2) The interrelationship of structure and function.

and 3) the body as a self-healing, self-regulating and self-adjusting mechanism.

The principles of cranial osteopathy are exactly the same as structural osteopathy.

They are the same principles as osteopathy. Dr Sutherland insisted the principles of the Primary respiratory mechanism, PRM are not different to Dr Still's osteopathic principles, conceived in 1874, but an extension of them to the head.

Dr Harold Magoun suggests – 'The cranial concept is perhaps the finest application of Osteopathy'.

Hopefully you are all fairly good with the anatomy. That is well documented. What I would like to talk to you about today is the physiology, especially with a nod the internal fluid environment. The external environment is a different matter and one I have been lost in, considering, for the last few years, but that is for another day!

I want to talk about some of the hypothesise and physiological mechanisms that researchers have been finding out about to show you that there may be a physiological/ scientific, if you prefer,

explanation to explain the concepts and philosophical teachings of Drs Still, Sutherland and Becker in terms of what we are feeling and working with under our hands and consider what explains the change we are experiencing clinically under our hands during treatment with regard to OCF.

Slide of Dr Sutherland and the disarticulated Skull at Kirsville.

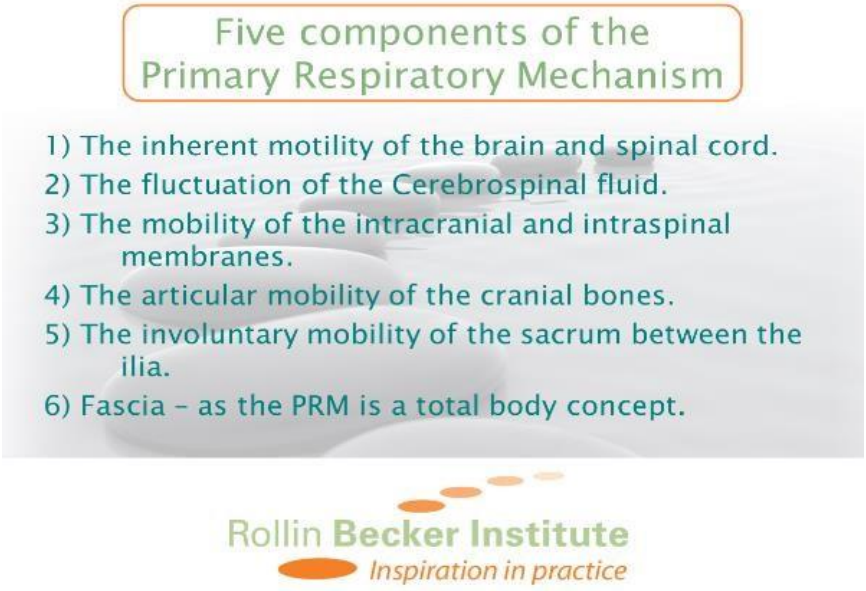
It was 1899 and Dr Sutherland was in the North Hall of the American School of Osteopathy at Kirksville.
He was looking at Dr Still's disarticulated Skull which was on display. His attention was on the Sphenosquamous suture between the greater wings of the Sphenoid and the squamous part of the Temporal bone. He had 'a blinding flash of light' a light bulb moment. He felt the suture was 'bevelled like the gills of a fish' and if structure governed function, one of Dr Still's principles of osteopathy, he felt 'It must indicate some kind of respiratory mechanism'.

He spent the following 10 years trying to dismiss the idea and when he couldn't, spent a further 20 years trying to prove it was false. In 1939 he published his book 'The cranial bowl' which outlined a hypothesis of what he called the Primary Respiratory Mechanism, PRM. Primary to reflect the importance he gave it to body physiology, more important than thoraco-diaphragmatic respiration which Dr Sutherland referred to as secondary respiration. He believed the cells of the body respired, aerobically and anaerobically for energy release. In a talk (Ref Anatomy of Potency AoP p10) Dr Sutherland referred to Dr Magoun's definition of respiration in which he described physiological respiration as 'cellular metabolism'. Few took his ideas seriously, rejecting his papers, not listening to his talks to the American Osteopathic Association, AOA and labelling him 'an erratic'. (There is more information, if required in Dr Magoun's book: Introduction in Osteopathy in the cranial field.)

Over the following 15 years Dr Sutherland developed his hypothesis in lectures and articles, His transcripts are published in his books: 'Contributions of thought' and 'Teachings in the science of osteopathy'.

Gradually with time, patients responded to treatment, osteopaths wanted to learn the approach.

He was taken seriously by the Academies and associations and in 1944 the first post graduate course was run at the osteopathic college. (Ref Dr Magoun'S preface)



The primary respiratory mechanism has Five components.

It represents a single unit of function, a total body concept.

1) The inherent motility of the brain and spinal cord.
2) The fluctuation of the cerebrospinal fluid.
3) The mobility of the intracranial and intraspinal membranes.
4) The articular mobility of the cranial bones.
5) The involuntary mobility of the sacrum between the ilia.

Because they represent a total body mechanism, many believe, especially in the American literature, we should now include the fascia as the sixth component. As you progress with your understanding of cranial osteopathy and see how the concept is applied to the fascia, as a total body unit, hopefully you will start to see why.

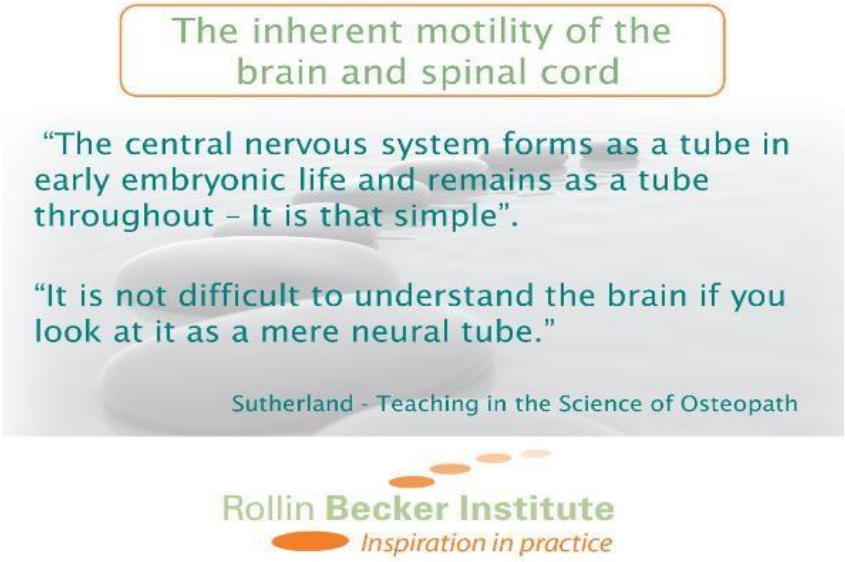
Magoun suggest they are primarily concerned with two physiological phenomena.

1) Motion present in the cranial sutures and
2) A rhythmic impulse within the cranium.

It seems today that these two phenomena form most of the explanation for what cranial osteopathy is!

Most websites for Cranial treatment seem to suggest that manipulating the cranial bones to improve the rhythmic impulse of the cerebrospinal fluid is what we do!

The components of the PRM all work together as a single unit of function, a total body mechanism, none is more important than any other. A problem in one will affect the others just as a cranial lesion will affect the spine and a spinal lesion will affect the cranium.



1) The inherent motility of the brain and spinal cord

Dr Sutherland said, 'the neural tube starts as a tube and finishes as a tube, it is that simple'. It is a tube, by 4 weeks of embryonic life, all be it more complicated as the cerebral part, grows, develops and specializes.

It is a tube but a very specialised tube.

The neural tube reaches the frontals and is turned laterally and posteriorly back around the parietals and then laterally and anteriorly to form the temporal lobes in 'a ram's horn' configuration. As these Rams are modelling.

Slide of developing brain (from Netter) and a picture of a Ram horn (From goggle images)

During primary respiration, the oscillations in the tube cause it to shorten, caudally/cephalically widen laterally and narrow anteroposteriorly in the inhalation or flexion phase and lengthen, caudally/cephalically, narrow laterally and increase its dimensions antero-posteriorly in the exhalation or extension phase. We say paired structures externally rotate in the flexion phase and internally rotate in the extension phase.

This starts to explain the shape change we get through a cycle of involuntary motion which we call flexion and extension and external and internal rotation.

Neural tube motility has been less controversial for many years, most of the evidence arising from neural surgeons who have identified different oscillations arising from cardiac contraction, respiratory oscillation, inspiration and expiration and 'unidentified' oscillations not related to the heart and breathing. In the early days researchers put this down to inherent motion in the Glial cells and the oligodendroglia, (Ref Anatomy of potency, AoP p8) although it is claimed there are too few to move the brain in this way and contraction is to slow in vitro.

Actin and myosin have been found in brain tissue.

Students have postulated that electrical energy maybe generated by a natural dynamo effect with the coiling and uncoiling of the neural tube during inhalation and exhalation.

Dr Sutherland talked of respiration -

A second possible explanation may come from researchers like Brinker who suggests the brain is bathed in CSF and the motility may well come from a fluctuation of the CSF inside it.

Nick Handoll (AoP p29) suggests the CNS is to passive and suggests this may be due to the specific gravity of the brain being 1.04 whilst the specific gravity of the CSF 1.007. The brain weighs 1.5Kg in air and weighs 50g in CSF (2 oz). He suggests that the CNS should be included as part of the CSF which means motion in the CSF occurs almost as equally through the CNS.

That brings us nicely onto consider:

2) The fluctuation of the cerebrospinal fluid.

I said that all the principles were as important as each other but saying that Dr Sutherland and Dr Still believed the fluctuation of the Cerebrospinal Spinal Fluid was the most important principle. The concept of fluctuating CSF is an extension of the 'rule of the artery is supreme' as we will see in a minute, Dr Sutherland endowed it with names like 'liquid light' and the 'breath of life', believing it was essential to life and physiology.

We know the CSF circulates, that hasn't been controversial, pickup any physiology book and you can read about the circulation of the CSF. Although saying that, The circulation is still being reevaluated. Brinker suggests much of the evidence for CSF circulation is flawed, The research methodology has to to be questioned and a lot of 'newer' research suggest CSF moves in a fluctuant way.

Slide (from Netter) showing circulation of CSF through ventricles to cisterns

Classically, CSF is produced predominantly in the Choroid plexus, from the 41st day in the 4th ventricle. The classical model has the CSF produced in the Choroid Plexuses in the 3rd and 4th ventricle walls, although this production is being re-evaluated.

Along with their supportive tela chorioidea, the choroid plexus form CSF from filtered blood plasma and then modify it before secretion into the ventricles. Once secreted CSF circulates from the choroid plexuses of each ventricle, from the lateral ventricle it flows to the third ventricle through two narrow oval openings, the interventricular foramina, also called the foramina of Munro. Flow is unidirectional, from the direction of the nose towards the tail, rostrocaudally. More CSF is secreted by the choroid plexuses in the roof of the 3rd ventricle. CSF flows through the Cerebral Aqueduct, also called the aqueduct of Sylvius, which passes through the mid-brain into the 4th Ventricle. From here it passes through the foramen of Magendie and the foramina of Luschka to the subarachnoid space outside the neural tube, into a system of cisterns, in the subarachnoid space, the Cisterna Basalis under the brain, the cisterna magna or cerebellomedullary cistern, around the brain stem. 'waterbeds upon which the brain rests' (AoP p29). It flows rostrally towards the nose to the sites of absorption.

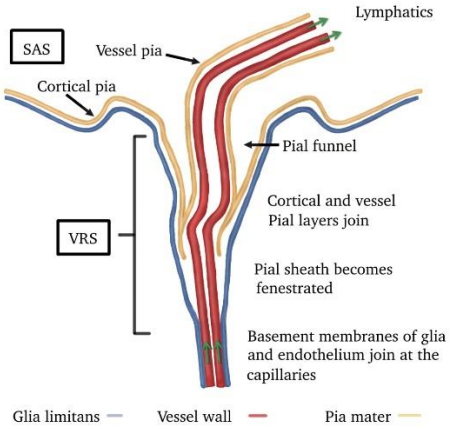
The rest of the CSF moves down the central canal of the spinal cord and out through the spinal foramen of Nakajima into the subarachnoid space around the spinal canal.

Of the 150mls in and around the brain, the classical model has some of this CSF draining into blood sinuses, mainly the superior sagittal sinuses via the cranial and spinal pacchionian granulations (also known as arachnoid granulations or villi), largely situated in the superior sagittal sinus but also rarely found in the transverse, superior petrosal, cavernous and sphenoparietal sinuses. They are finger like endothelium lined protrusions of the arachnoid mater, protruding through the dura mater into the lumen of the venous sinuses. REF CSF A+P REF 22)

This method of drainage has been questioned!

The pressure gradient between the subarachnoid space and the venous sinus has to be between 3 and 5 mmHg. Absorption of CSF is a dynamic process which adapts the filtration rate to CSF pressure. Spinal arachnoid villi absorb more during exertion and lumbosacral arachnoid villi absorb more when we are upright.

It is looking increasingly more likely that absorption of CSF occurs via the Virchow-Robin perivascular spaces.



Picture of VRS adapted from 'A new look at cerebrospinal fluid circulation' written by Thomas Brinker, Edward Stopa, John Morrison, Petra Klinge – open access. Images available of the original if you goggle this!

The Virchow Robin spaces are funnel shaped recesses which form where arteries pass from the subarachnoid space into the brain parenchymal tissue and where the veins emerge from the brain parenchymal tissue. The sub arachnoid space is lined with glial cells which make up the blood brain barrier. They line the walls of the pia mater and descend into the VRS where they merge around the capillary level.

The pia surrounds the arterial and venous wall but leaves a small perivascular space around the vessels.

Some CSF drains into the VRS where it can be reabsorbed into the cranial sub-arachnoid space or back into the capillaries passing through the parenchyma. Some can drain into the perivascular space surrounding the artery returning to the lymphatics or at the venous end can pass into the perivascular space around the vein. This has been termed the glymphatic system and although it remains controversial, drains CSF down into the deep cervical and jugular lymph nodes back to the venous system.

In essence, Brinker suggests CSF seems to move through fluctuation than circulation!

Less controversial as it was, research also suggests CSF drains along the perineural spaces of the cranial nerve sheaths, namely the trigeminal, cochlear and optic nerves.

A large proportion of CSF drains through the cranial base through the axon mucosa of the olfactory nerve (CN1) through the cribriform plate and the adventitia of the cerebral arteries into the nasal submucosa and into the lymphatic system in the neck.

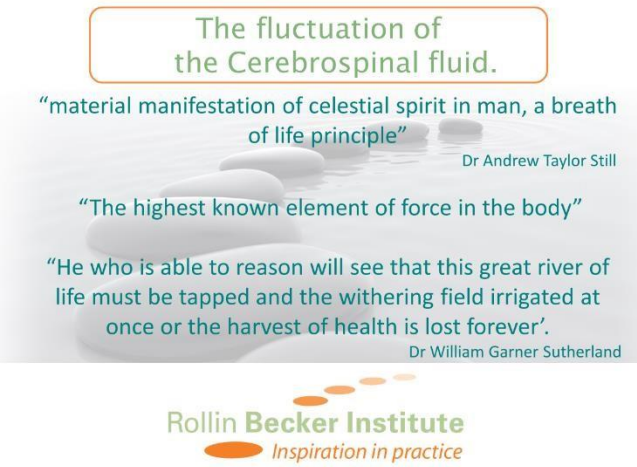
Recent research has also identified a cochlear aqueduct in the petrous part of the temporal bone which links the subarachnoid space of the posterior cranial fossa to the peri-lymphatic space in the cochlea. (Ref CSF Anatomy and physiology Ref 36 and 37)

The CSF draining from the spinal subarachnoid space passes along the perineural spaces of the spinal nerves, along to the end feet of the nerves. In the 1960s, with the advent of the electron microscope, it was found that collagen tubules where made up of a triple helix molecules and their lumens were large enough to contain CSF. This lead Dr Ralph Erlingheuser, in the 1960s to suggest a hypothesis which suggested that if the fascial network was continuous, CSF could pass from the perineural spaces, through the collagen tubules of the fascia where they are continuous with the Connective tissue network, through to the extracellular matrix and lymphatics. He proposed this could explain Dr Sutherland's concept of the primary respiratory mechanism and the breath of life principle through the body.

CSF is the third circulation of the CNS as lymph is the third circulation of the body and drains through the arachnoid villi and into the microtubules of the fascia. There are no lymphatic channels in the brain and CSF fulfils the role of returning interstitial fluid and proteins to the circulation.

Let's consider the Fluctuation, this has been more controversial over the years but there is an awful lot of research being done presently that is relooking at the properties and physiology of CSF that is shedding light on what Dr Still and Dr Sutherland were saying more than 80 plus years ago. It is proving that they were at least seers and at best visionary.

Why does it fluctuate?



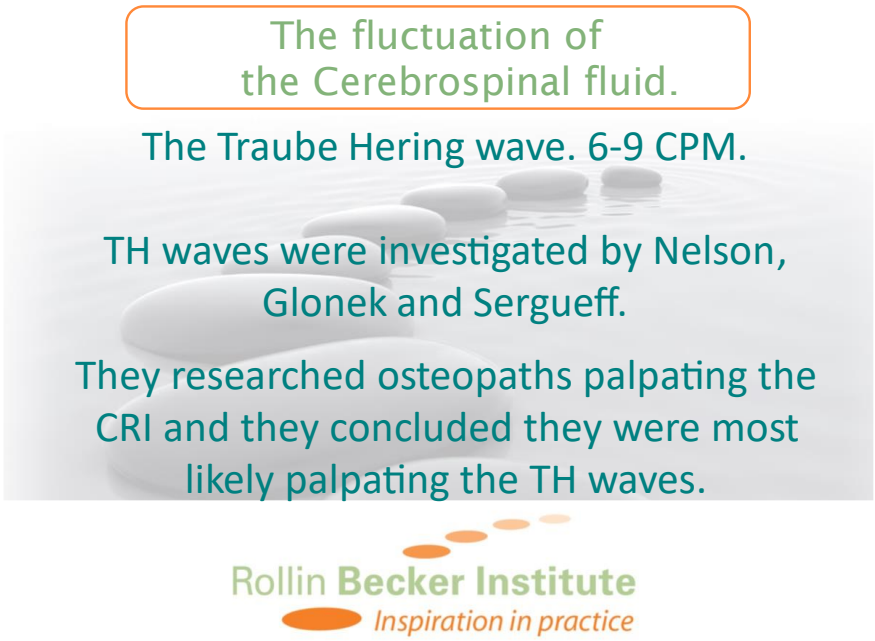
The sexy, philosophical view, taught by Dr Still, is that the CSF fluctuation is a 'material manifestation of celestial spirit in man, a breath of life principle'.

Dr Still was a religious man, he had been born into a devout Methodist family in 1828 in Virginia.

He served for the union in the American civil war before settling in Kirkville, Missouri as a doctor. A series of family bereavements to Meningitis shook his faith in the medicines of the day. He believed man was created in gods eye and should therefore be perfect. As we know, this eventually led him to look for mechanical dysfunction as the cause of disease.

They didn't have the scientific knowledge we 'enjoy' today and learnt by observation within their belief system and talked using the language of the time.

Dr Sutherland called it 'the highest known element of force in the body…and he who is able to reason will see that this great river of life must be tapped and the withering field irrigated at once or the harvest of health is lost forever'.

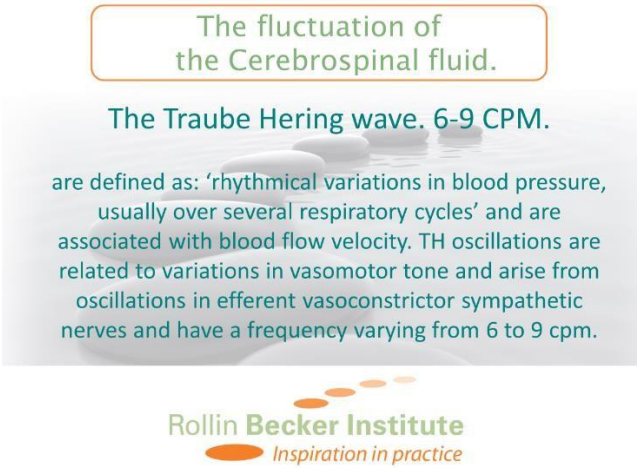


The less sexy and more modern scientific view is that the involuntary motion we associate with the fluctuation of the CSF is most likely associated with and arises from the Traube Hering wave. The phenomenon was discovered by Ludwig Traube in 1865 and was attributed to intrathoracic pressure fluctuation of pulmonary respiration. Traube noted the oscillations, in pulse pressure, continued after the cessation of respiratory motion. Ekbert Hering confirmed Traube's discovery in 1869.

TH waves were investigated by Nelson, Glonek and Sergueff in the 2000s. They researched osteopaths palpating the CRI, the cranial rhythmic impulse or more correctly the involuntary motion in the head, and they concluded they were most likely palpating the TH waves.

Magoun suggests IM is around 8-12CPM

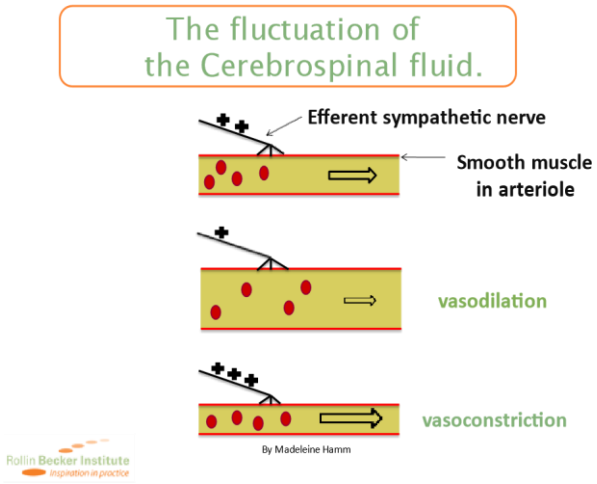
All the physical, mechanical and electrochemical features described are related to this movement.



TH waves are defined as '*rhythmical variations in blood pressure, usually over several respiratory cycles' and are associated with blood flow velocity. TH oscillations are related to variations in vasomotor tone and arise from oscillations in efferent vasoconstrictor sympathetic nerves and have a frequency varying from 6 to 9 cpm'.*

That's confusing so

Let's look at the diagram below, produced by my youngest Maddie, to illustrate this definition.



This shows the efferent sympathetic nerve, in black. Oscillating around 6-9 cpm.

The nerve innervates the smooth muscle, the red line, of the arteriolar wall which gently dilates and constricts.

The TH waves arise from the flow of blood in the arterioles. The smooth muscles of the arterioles are innervated by efferent sympathetic nerve fibres which cause the muscles to constrict and dilate around 6-9 CPM. Under resting conditions, almost all systemic arterioles are constricted to around half their maximal diameter by ongoing sympathetic tone. A decrease in sympathetic output leads to vasodilation and an increase leads to further constriction. Without this mechanism sympathetic output could only increase and only control constriction. The constriction and dilation change the velocity of the blood flow through them as this produces the TH wave!

Vasomotion is the same mechanism except it is not necessarily dependent on the efferent sympathetic nervous input and the oscillations are measured from the smooth muscle rather than blood flow. Many believe that the TH waves and vasomotion to be the same mechanism.

At first glance, the Traube Hering waves have a lot of the attributes of the involuntary mechanism.

They are synchronous in large parts of the body and are a fundamental physiological process in the health and homeostasis of all organs and tissues. They act throughout the fluid, membranous, nervous and osseous tissue.

They might account for the conceptual idea of involuntary motion!

It is a shame to think we are only palpating ‘rhythmical variations in blood pressure, usually over several respiratory cycles’ and that these are related to ‘variations in vasomotor tone arising from oscillations in nervous tissue, sympathetic efferent vasoconstrictor nerves searching around a homeostatic mean. Mcgrath calls it ‘a manifestation of an extra cranial blood flow phenomenon’.

So, the sexy material manifestation of celestial spirit, a breath of life principle, on one hand or the TH waves, a rhythmical variations in blood pressure, usually over several respiratory cycles', 'a manifestation of an extra cranial blood flow phenomenon' on the other!

The question we must consider is does this matter?

The fluctuation of the Cerebrospinal fluid.

'tactile sense tests are indicated to determine changes in fluid fluctuation, found palpable throughout cranial and systemic areas. The changes in fluctuation of the fluid are common indications of pathological systemic and structural disorders, acute and chronic. Cranial treatment is valuable towards restoration of the rhythmical, balanced interchange'.

Rollin Becker Institute
Inspiration in practice

Dr Sutherland wrote in the foreword of Osteopathy in the cranial field that 'tactile sense tests are indicated to determine changes in fluid fluctuation, found palpable throughout cranial and systemic areas. The changes in fluctuation of the fluid are common indications of pathological systemic and structural disorders, acute and chronic. Cranial treatment is valuable towards restoration of the rhythmical, balanced interchange'.

This is an important statement.

This implies we are not treating the involuntary mechanism per se, but the restrictions impeding its expression and function and then as the 'disorders of the skeletal system', 'restore' we feel a change in the expression and quality of the involuntary motion?

I think a lot of people working with the cranial concept, especially researchers do not understand this.

Does it actually matter what 'tactile sense test' we use to determine the change?

Take the analogy of a car battery.

How do we know it is any good? We can put a tester across it and measure various characteristics such as voltage, current, resistance. We are the same with our tactile sense tests! If there are less

volts, it struggles to power the circuit. If there is resistance in the circuit or loose wires the voltage is affected. We 'mend' the circuit and the voltage improves. We can charge a 'flat' battery with a charger. The power in the circuit improves. We are the same, through CV4s and still points, we can charge the Involuntary motion, whatever it is, and register an improvement through the IM!

It is no different with a structural approach, you use a tactile sense test to assess the range of motion in a joint, use articulation, manipulation or a soft tissue approach to ease the restriction and reassess the range of movement.

Developing this subtle palpatory/tactile proprioceptive awareness or sense takes time, every practitioner is different and we explore it more in the palpation course.

I know this is at best only of academic interest, but it is a question I have been pondering for a few years and why I started to look into the 'science' a little more. Each OCF practitioner feels something different 'explains it in different ways, Dr Sutherland suggests, it is 'the change each practitioner interprets through their palpation' which is important.

Do the Traube Hering waves explain the conceptual idea of Sutherland's 'spark', the 'liquid light' that animates a being into life, the breath of life principle? Dr Sutherland's most important principle was the fluctuation in the cerebrospinal fluid, the 'fundamental unit in the functioning of the primary respiratory mechanism. The 'physical potency or energy' which seems to act through the body as a hydrodynamic mechanism' as Ian Scofield described tonight, or the electrical potential acting in positive or negative phases. (Magoun p25)

Can the TH theory be used to explains potency?

Remember we mention the CSF drains from the perineural spaces through the microtubules of the collagen into the connect tissue network, being continuous down through the fascial network of the body?

Further theories were suggested by Dr Paul Lee in his book 'Iinterface, mechanisms of spirit in Osteopathy'. he suggested an electrical potential across the collagen tubule produced a calcium flux through the ECF.

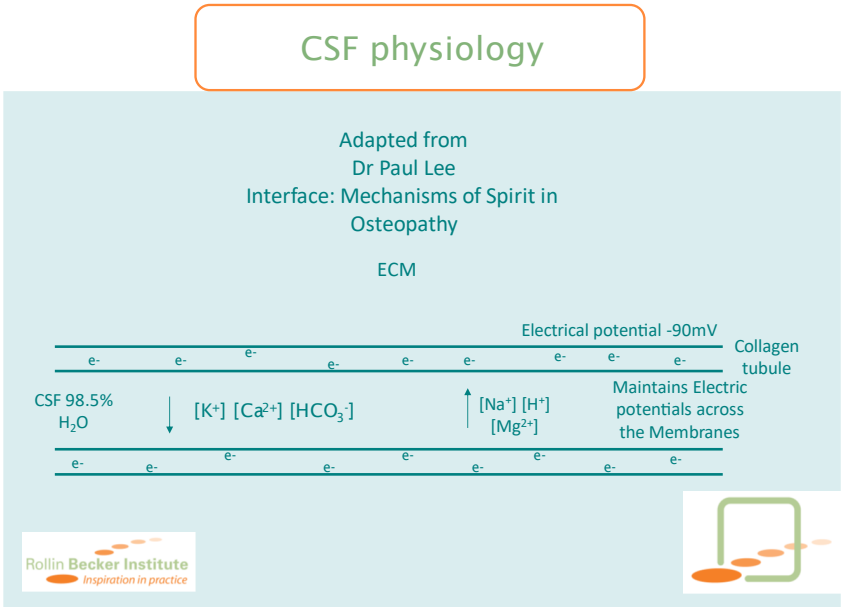
Dr Lee states "It is my belief that what we feel in the tissues as the tide is related to the waves of calcium ions and the accompanying water, which is associated with alterations in the viscosity and charge of the matrix."

Slide of a collagen molecule.

The properties of collagen; this slide is of the collagen molecule at 17,500,000 X. It consists of three twisted helixes which are bonded together by hydrogen bonds to form a triple helix. The molecules

line up, side by side and attach to one another, like overlapping bricks, via the same kind of hydrogen bonds to form fibrils. This molecular arrangement of collagen allows it to assume a dipolar arrangement, i.e. the ability of a collagen molecule to reverse its orientation at a single location along the fibril. This gives it some interesting properties. The first is, it acts as a semiconductor. It is suggested that this property allows collagen to hold a charge, it can conduct electrons, which can move around the fibres, rather than the fluids, a little like cars on Britain's road system and is responsible for its piezoelectric (shape and charge) and thixotropic properties.

For this reason, you will often here it referred to as a Crystal lattice or liquid crystal matrix. These explanations are other terms for the same thing.



This diagram represents a collagen tubule made up of the triple helix molecules. The collagen is surrounded by extracellular matrix, ECM which provides a fluid medium through which substances are exchanged between the blood and cells. Paul Lee in his book 'interface' postulates that the ionic composition of the CSF, within the collagen microtubule, allows an electrical potential of around -90 mV, to exist across the collagen microtubule between the CSF and the surrounding ECF. The inside is negative relative to the outside).

Now the observant amounst you will remember that CSF and ECM have a similar composition, it is known as a transitional fluid, differing from Interstitial fluid, ISF, and Plasma!

We know CSF drains into the microtubules as hypothesised by Dr Ralph Erlinghauser and sets up an electrical potential across the membrane.

CSF basically consists of ions and water. It is made up of 98.5% water. The other 1.5% is made up of ions, glucose, neurotransmitters, proteins, oxygen, lactic acid, uric acid, urea and waste products in a dissolved form and white blood cells and proteins, in low concentrations. There is a high concentration of hydrogen ions (H^+) due to the water content, and a high concentration of sodium (Na^+), chlorine ions (Cl^-), magnesium ions (Mg^{2+}) and but lower concentrations of potassium (K^+), bicarbonate ($HCO3^-$) and Calcium ions (Ca^{2+}), all dissolved or in ionised forms. These concentrations are higher and lower, respectively than the associated concentrations found in the plasma which suggests it is actively secreted by sodium potassium pumps.

In the ECM are a network of Proteoglycans made up of GAGs (glycosaminoglycans like glucosamine and chondroitin).

We know calcium levels in the ECM are maintained at supersaturated levels with massive storage capacity in the bones. These supersaturated levels are maintained often to the detriment of bone strength.

The calcium fluxes are produced from calcium release in the sarcoplasmic reticulum and is under sympathetic control.

Fascia gross structure.

We know fascia is made of cells, fluids and fibres, is endlessly adaptable and is continuous.

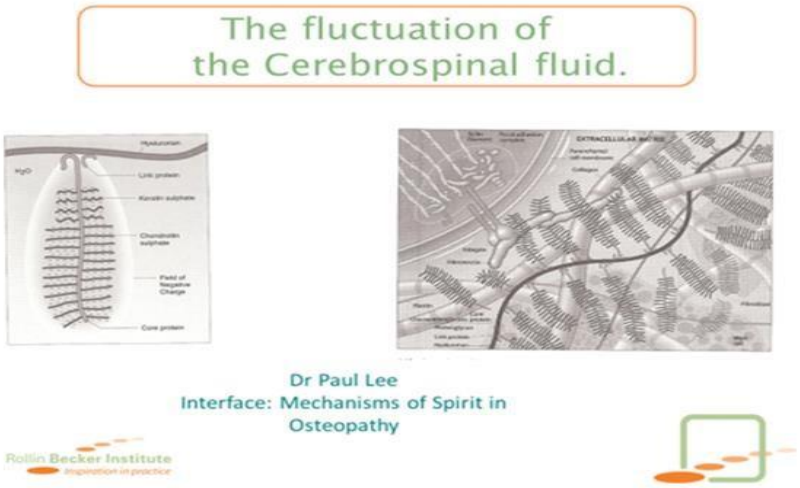
It is also continuously tense and behaves as a tensegrity system.

Slide of Fascia composition from Grays anatomy

If you are all familiar with this slide from Grays Anatomy. It shows the nerves fibres and the blood vessels – capillaries, the lymphatic channels. Collagen fibres, reticulin fibers, (immature collagen), elastin fibres, the cells of immunology histiocytes, mast cells, and macrophages. There is in this array a network of microfilaments and microtubules, adherent to tensegrity principles that allow movement of these cells along a network of microtubules and microfilaments running throughout the body. (They can move along these chains like a monorail train).

The ground substance is not typically referred to as amorphous ground substance anymore. It is a highly dynamic matrix, fluxing between a thermodynamically highly unstable gel (Jelly), and a fluid (sol) state. It is highly organised and specialized.

These are elastin fibres. There are also long thin fibres of Hyaluronin. They form early in embryologic life and run continuously from head to foot and their formation has been linked to the appearance of the Involuntary Motion, IM in the foetus by Viola Fryman.



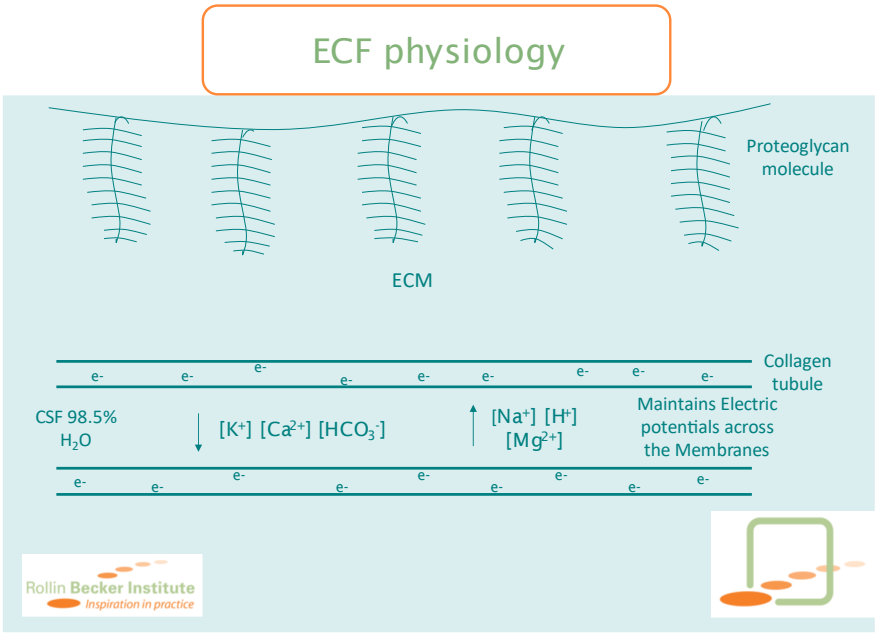
Dr Lee describes how the microstructure of the fascia is made up of a network of proteoglycans (PGs), glycoproteins (GPs) and glycosaminoglycans (GAGs), all attached to the hyaluronin. The PGs are negatively charged and form a film of negative charge around them. They are hydrophilic (attract water) and bind water and naturally, due to their unstable thermodynamic properties, form a gel. Because they are negatively charged the chrondroitin sulphate molecules repel each other and makes them stand out like bottle brushes. The whole structure allows the ECM to act as an essentially unstable semiconductor, a liquid crystal. Electrons freely move through the collagen and waves of ions can freely move through the matrix.

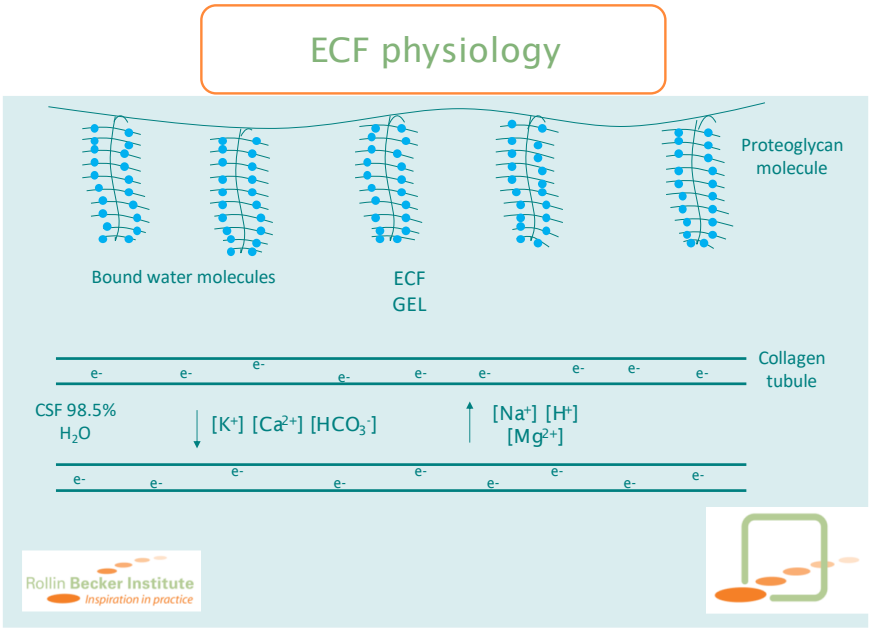
The collagen and PGs are surrounded by ECM and form a ‘sieve’ which provides a fluid medium through which dissolved metabolites / substances are exchanged between the blood capillaries to the cells and from the cells to the capillaries.

Dr Lee postulates that the ionic composition of the CSF, within the collagen microtubule, allows an electrical potential of around -90 mV, to exist across the collagen microtubule between the CSF and the surrounding ECF.

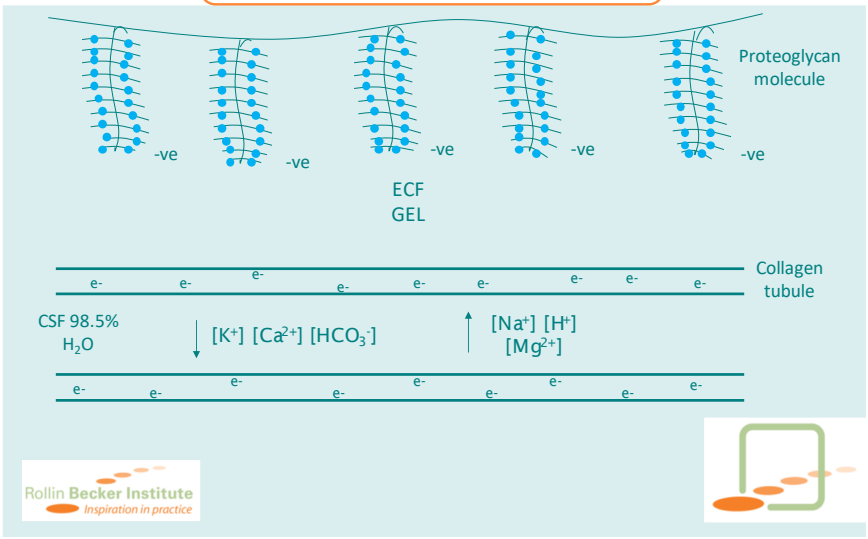
Dr Lee suggests this electrochemical potential drives a calcium wave/flux, “fluctuating redox potentials”, towards the electronegative cell membrane, taking with it a flux of water, i.e. calcium

moves from areas that are less negative, or more positive, to areas that are more negative or less positive. H^+ ions (counterions) move in a counter direction as the Ca^{2+} ions depolymerise the bound water on the PGs. As the unbound water effectively creates a lowering in the Ca^{2+} ion concentration and a more positive charge, the calcium will move to an area that is more negative, the water behind will then repolymerise or rebind to the PGs and the process can continue.

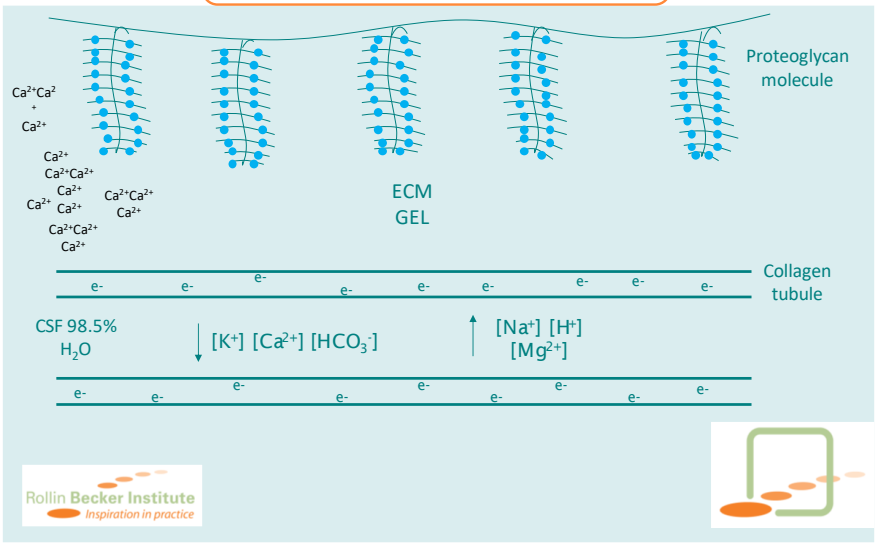


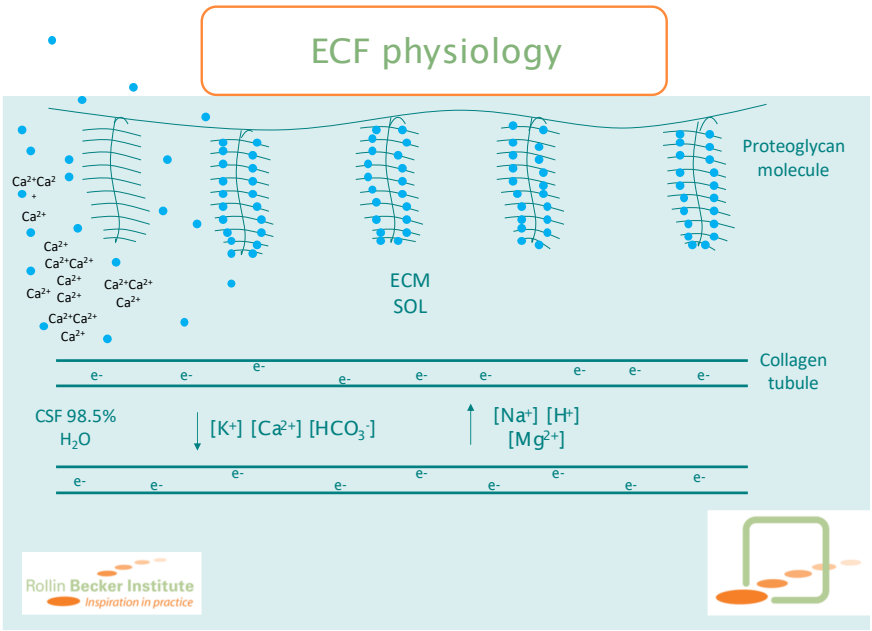


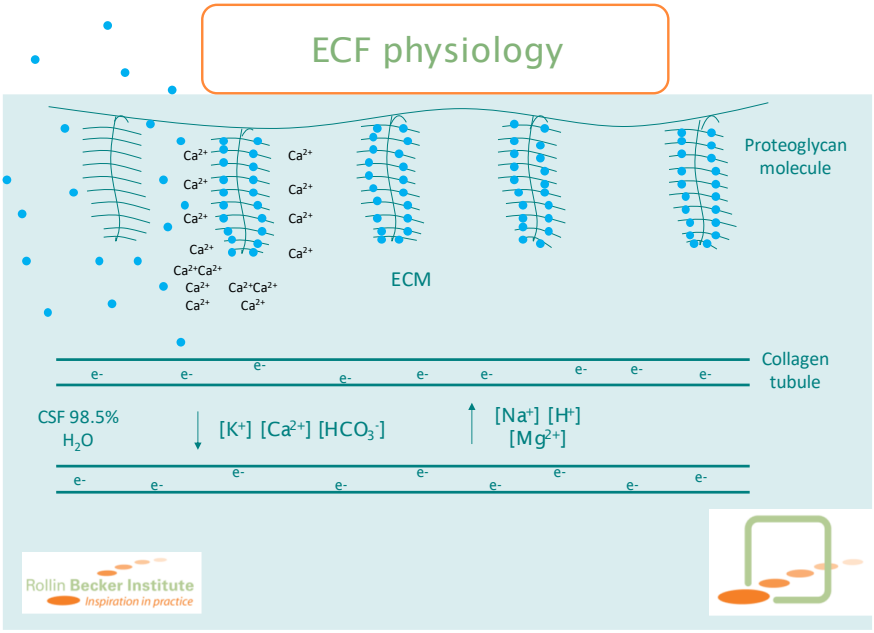
ECF physiology



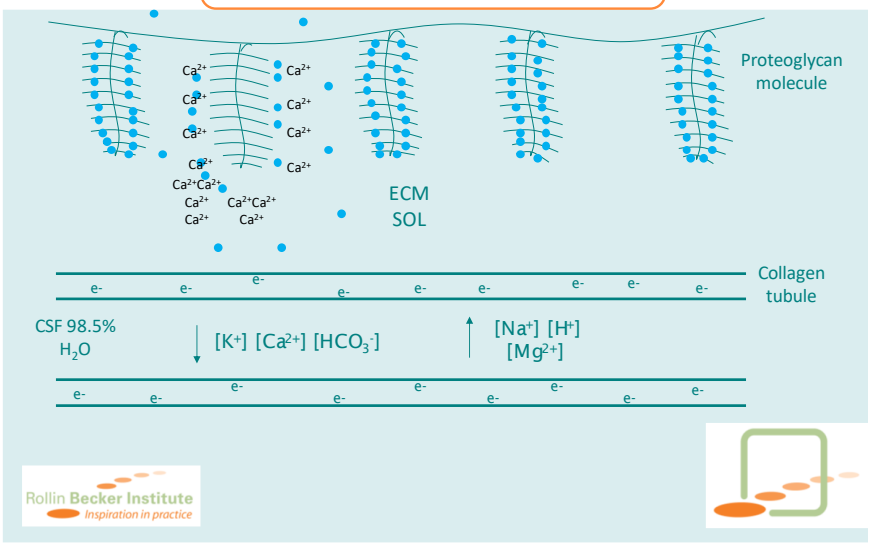
ECF physiology



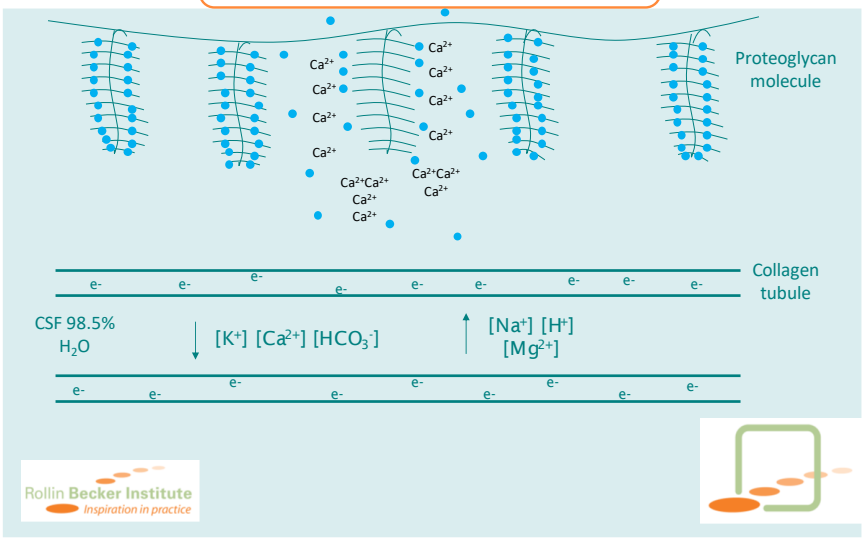

ECF physiology
Proteoglycan molecule
ECM
SOL
Collagen tubule
CSF 98.5% H_2O
$[K^+]$ $[Ca^{2+}]$ $[HCO_3^-]$
$[Na^+]$ $[H^+]$ $[Mg^{2+}]$
Rollin Becker Institute
Inspiration in practice

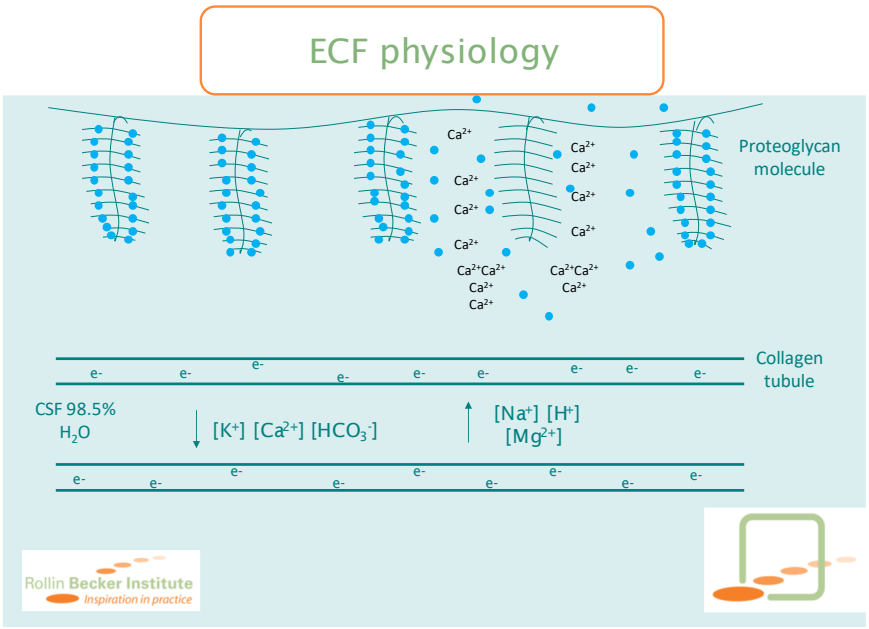

ECF physiology
Proteoglycan molecule
ECM
Collagen tubule
CSF 98.5% H_2O
$[K^+]$ $[Ca^{2+}]$ $[HCO_3^-]$
$[Na^+]$ $[H^+]$ $[Mg^{2+}]$
Rollin Becker Institute
Inspiration in practice

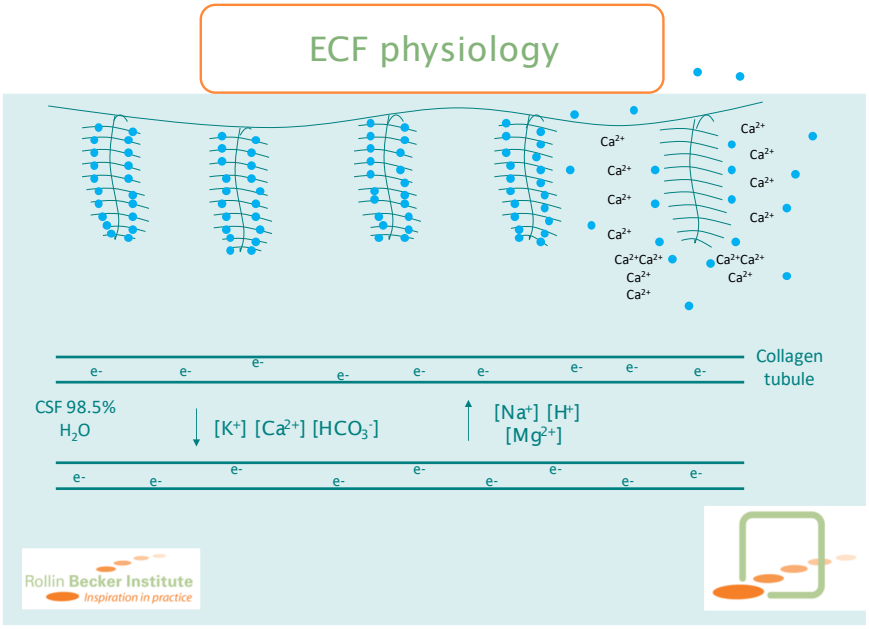
ECF physiology

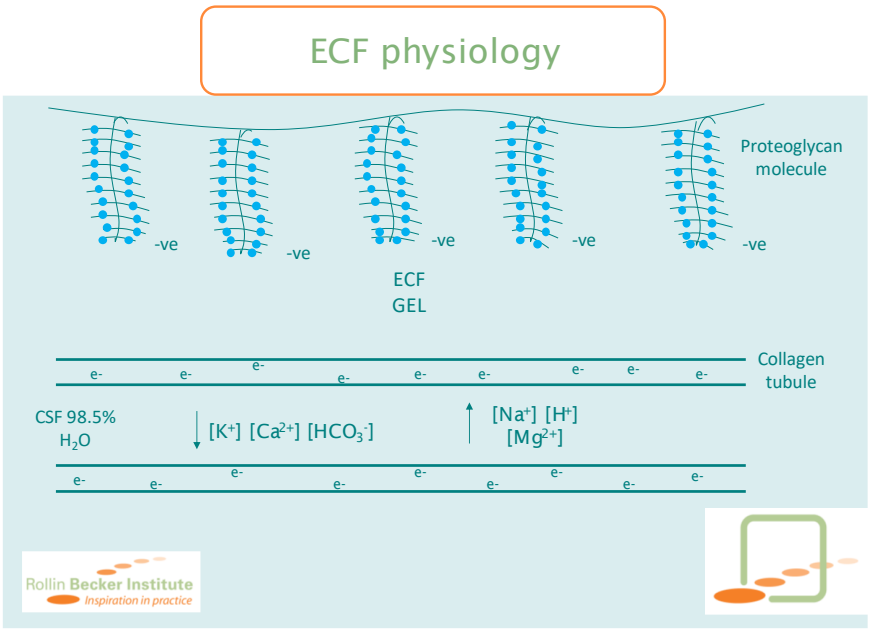


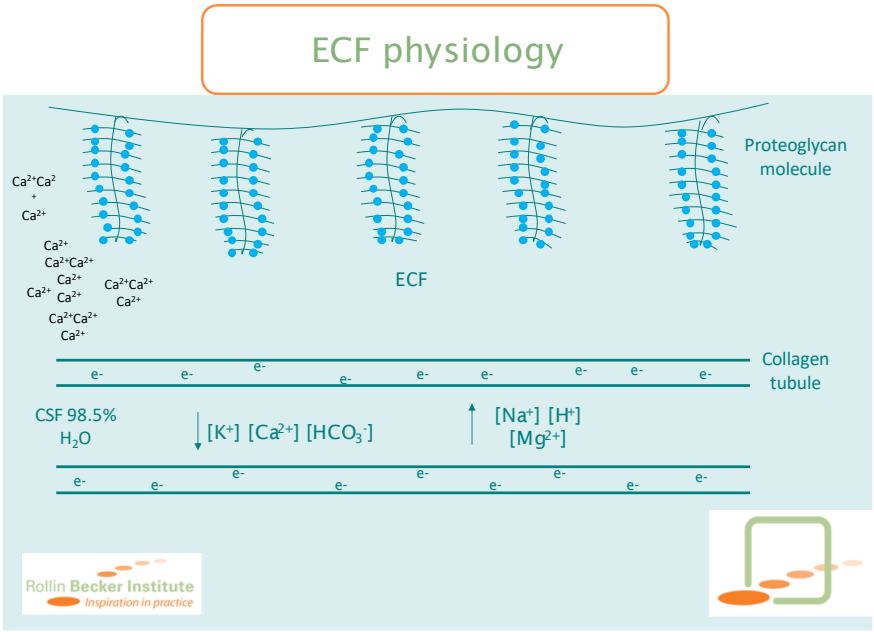
ECF physiology




ECF physiology
Proteoglycan molecule
Collagen tubule
CSF 98.5% H_2O
$[K^+]$ $[Ca^{2+}]$ $[HCO_3^-]$
$[Na^+]$ $[H^+]$ $[Mg^{2+}]$
Rollin Becker Institute
Inspiration in practice

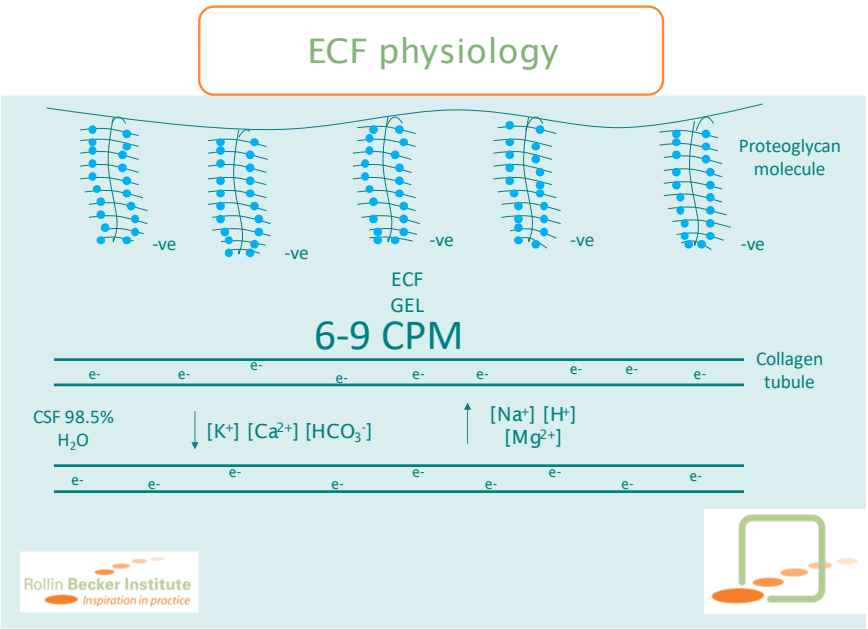

ECF physiology
Collagen tubule
CSF 98.5% H_2O
$[K^+]$ $[Ca^{2+}]$ $[HCO_3^-]$
$[Na^+]$ $[H^+]$ $[Mg^{2+}]$
Rollin Becker Institute
Inspiration in practice





Question: Can anyone guess at what speed this is Fluxing?

Answer: This is all fluxing at around 6-9cpm. Exactly the same as the TH wave oscillations!



Dr Lee argues that this produces an intelligent fluid drive which is essential to the health of the tissues.

"This basic fluid drive has an important task of providing an adequate trophic interchange between all the cells of the body and the entire connective tissue or fascial framework." Dr Rollin Becker 'Life in motion' p234

"Through the understanding of the CSF and its fluctuation patterns, one is dealing with the rechargeable battery of Life." Dr Rollin Becker 'Life in motion' p77 PLUS

"The breath of life in the CSF tide is the fundamental principle in the PRM." Dr Rollin Becker 'Life in motion' p29

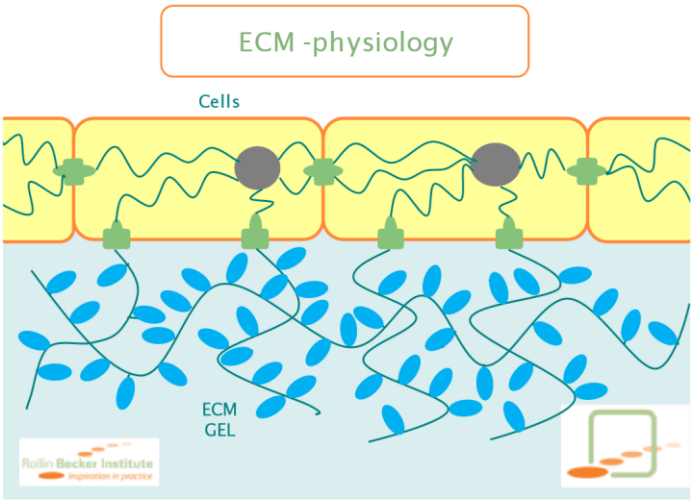
Let's take this a stage further. Consider the extracellular matrix. The collagen is continuous through the fascial matrix, conforms to tensegrity principles, being continuously tense. It is continuous through integrins in the cell membrane and continuous with the cytoskeleton, microtubules and microfilaments in the cell.

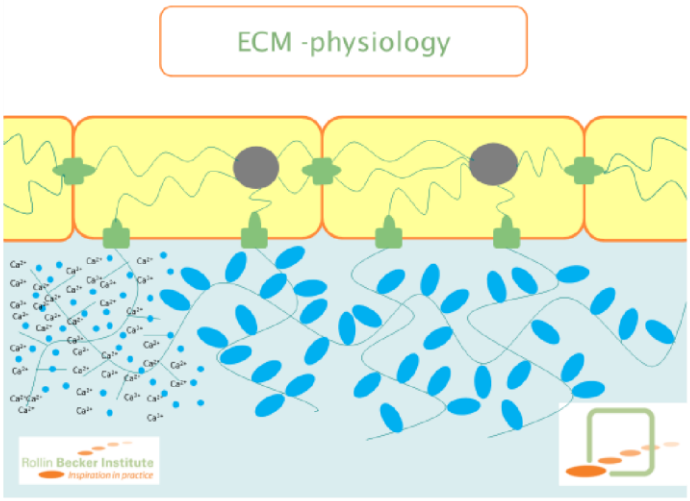
Slide of Integrins in plasma membrane showing continuity of collagen through to cytoskeleton

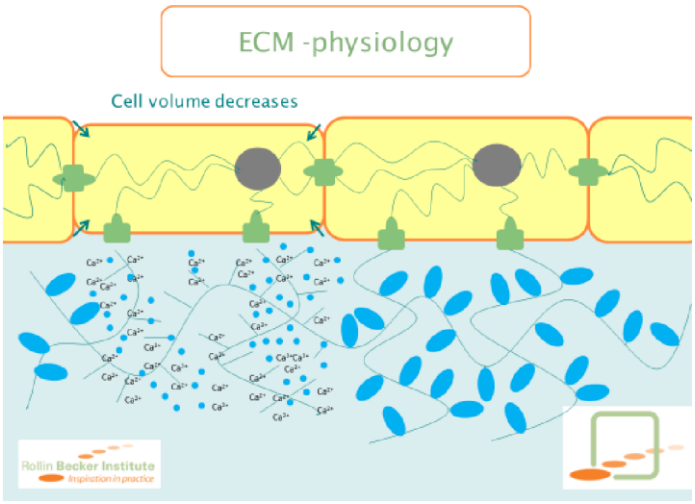
Tensegrity works through the body, hierarchically, at any scale from the skeleton right down through the fascias and extracellular matrix to the cells that make up the tissues and to the cytoskeleton and on into the array of molecules that make up the cells.

The cells derive their structure and tensegrity from the cytoskeleton's three major micro-filaments and from the extracellular matrix, the anchoring scaffolding from which cells are secured. The microfilaments are made of actin and extend through the cell, tensioning the cell membrane towards the nucleus, an inward pull acting as guy wires to stabilize the cell shape. This tensioning is opposed by two compressive effects, the first is outside by the extracellular matrix and the second is inside by microtubules, made of tubulin and bundles of microfilaments. Intermediate filaments, connect the microtubules and microfilaments to one another and link the cells membrane with the nucleus, acting under tension. (Ref Graham Scar - helical 83) In the cell membrane, Spectrin forms microfilaments and are tensioned by actin microtubule bundles under compression.

So picture our extracellular matrix, ECM, with the adjoining cells and remember there is a capillary adjoining the ECM.



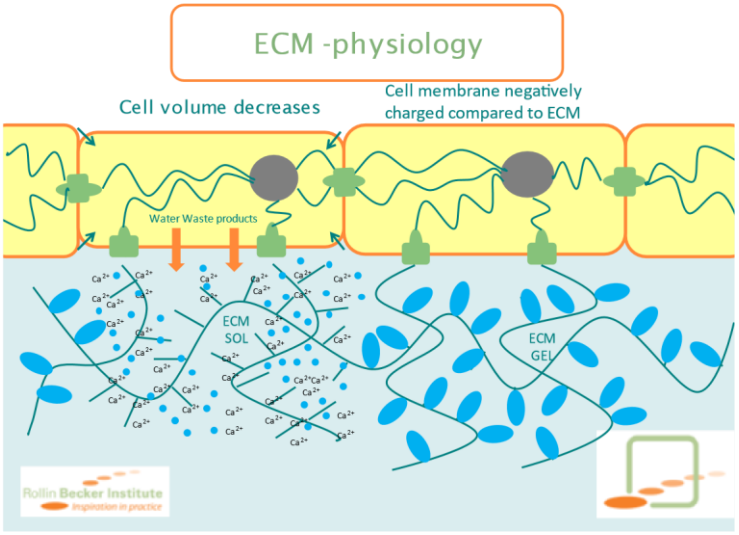




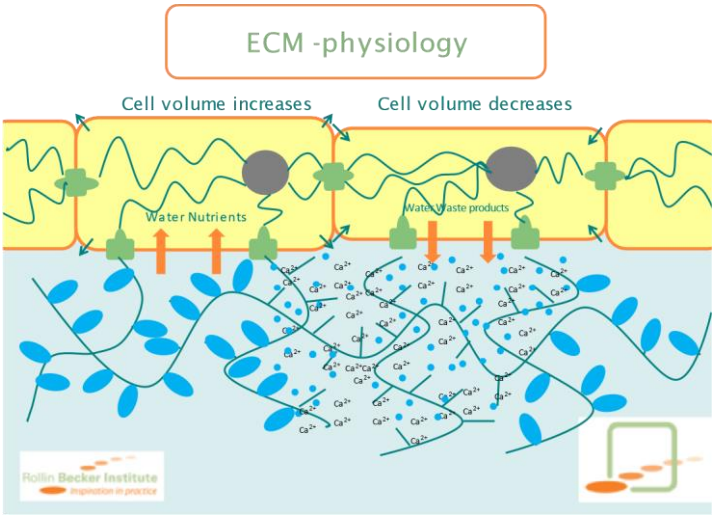
Water accompanying the wave of calcium ions moves the dissolved glucose oxygen and hormones from the nutrient capillary to the parenchymal cell much more quickly than diffusion can. Receptors on the cell surface receive these stimuli and enact metabolic functions within the cell. The cell membrane will have a proton gradient across it and ionic concentrations and concentration gradients

between the interstitial fluid, ISF and ECM are maintained through Na^+/K^+ ion pumps and facilitated Na^+/Ca^{2+} ion pumps.

Through integrins on the cell membrane, the microfilaments of the cytoskeleton contract with the stimulus of the calcium wave on the cell surface approximating microtubules and microfilaments inside the cell. Enzymes organised along the cytoskeletal system are approximated and allow certain cascades to occur.

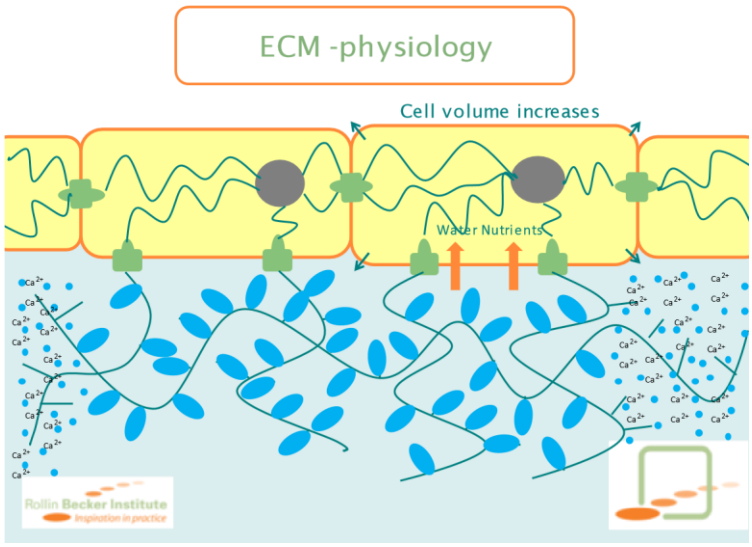


Water and waste products are forced out during the sol phase of the ECM into the capillaries and the open fenestrations of the neighbouring lymph channels. Water concentration outside the cell increases driving the free water into the venous and lymph capillaries. As the water concentration reaches a maximum, the calcium concentration reaches a minimum and the ECM repolymerises recreating a gel.



In the gel phase the fenestrations of the lymph vessels close trapping water and waste products in the lymph vessels. Nutrients flow into the cell with water as the cell swells. Enzyme systems that were activated in the cell contraction are deactivated while other enzyme systems are activated in

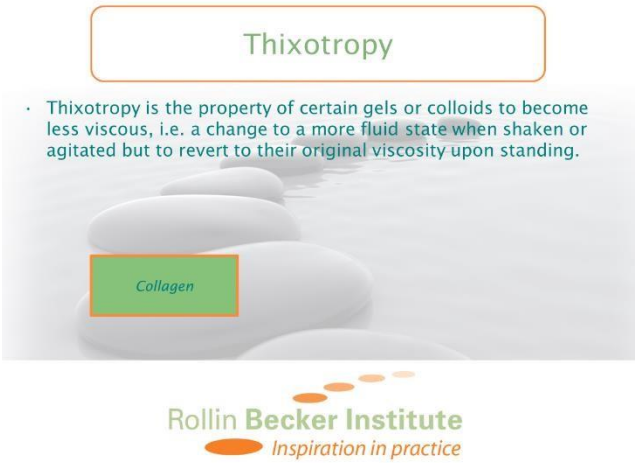
the swelling phase of the cell. Hydrogen ions have flowed in the opposite direction of the previous calcium wave to reset the electrial potentials and to generate another wave of calcium ions.



Do these physiological phenomena go some way to explain Drs Becker, Still and Sutherland's ideas of a 'Breath of Life principle' and an 'Intelligent fluid drive, a physical potency and an electrical potential'? Does this offer an explanation of how and involuntary motion can drive a balanced fluid interchange?

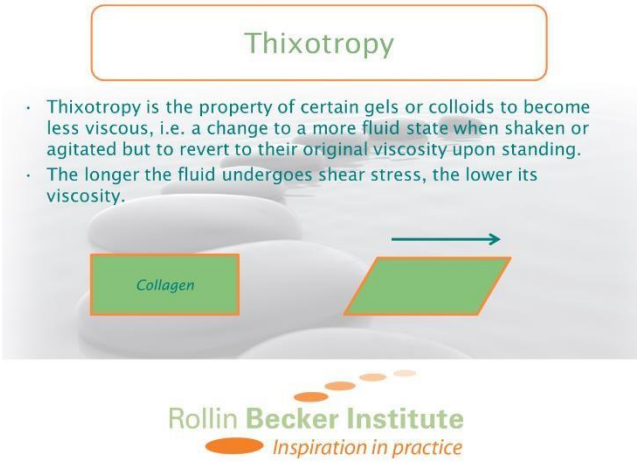
The calcium fluxes are oscillating at a rate of 6 cpm (6-10cpm) which most resembles and are again associated with the rate of the Traube Hering oscillations.

There are a couple of other interesting properties of Collagen to consider in the treatment hypotheses.



Thixotropy. Thixotropy is the property of certain gels or colloids to become less viscous, i.e. a change to a more fluid state when shaken or agitated (or have energy put into them) but to revert to their original viscosity upon standing. i.e custard. Our ECM is a lot like custard, put it in the fridge, it becomes solid but warm it up and give it a stir and it becomes more fluid.

It also becomes more fluid with shear stress.

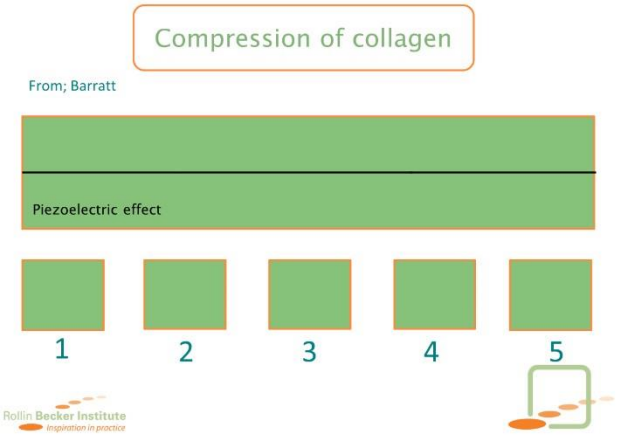


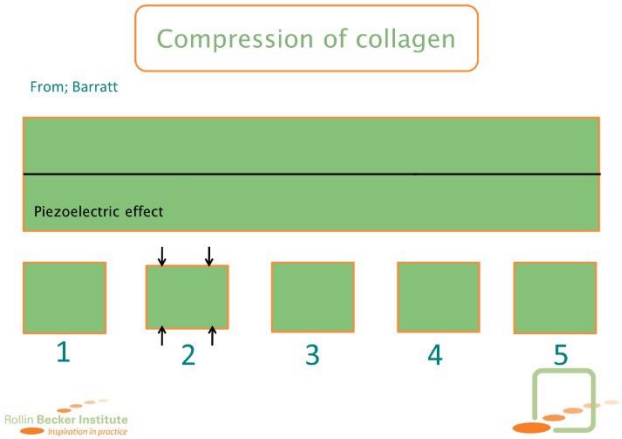
The longer the fluid undergoes shear stress, the lower its viscosity. The shear stress is the easy direction into which it moves which will produce a fluid state, we can physically move the fascia, which is largely made up of collagen towards an easy direction ie to a point of balanced tension to effect a more fluid feel. Equally we move the fascia away from its shear potential, away from its point of balanced tension and make things feel stiffer. It may explain how massage works by warming the muscles up and taking them to an easy position or a more 'functional osteopathic approach'? It also explains why the effect of massage are fairly short term and the muscles then reverse back to their original state.

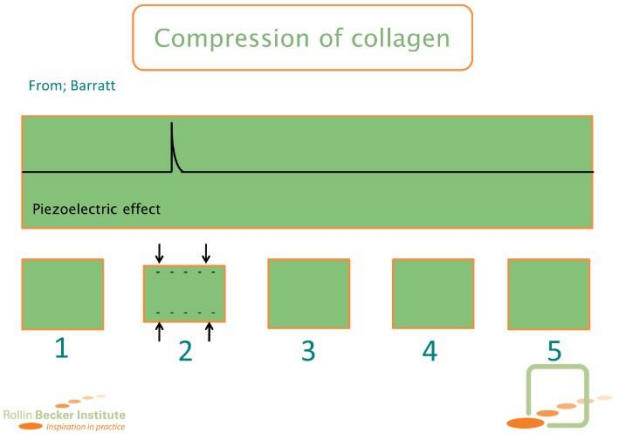
The second are the effects of compression on the collagen.

Collagen shows Piezoelectric properties. Everything with a shape has a charge and everything with a charge has a shape. Change the shape and you change the charge and vice versa.

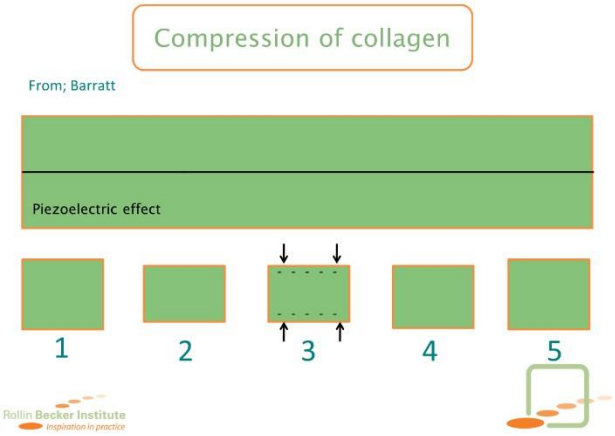
Barrett, investigating the piezoelectric effects of collagen, found that if you compress collagen you get a piezoelectric charge.



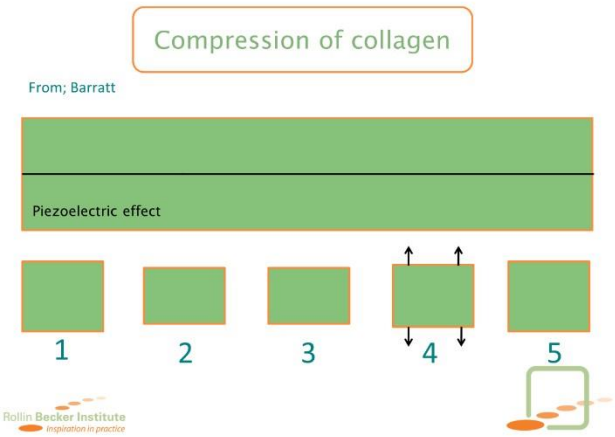




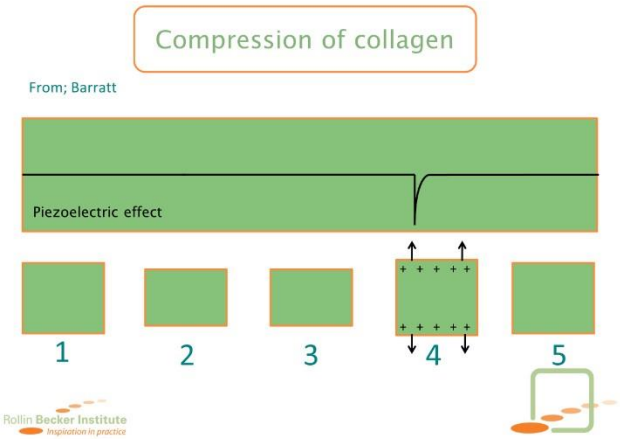
but this trace discharges almost immediately…



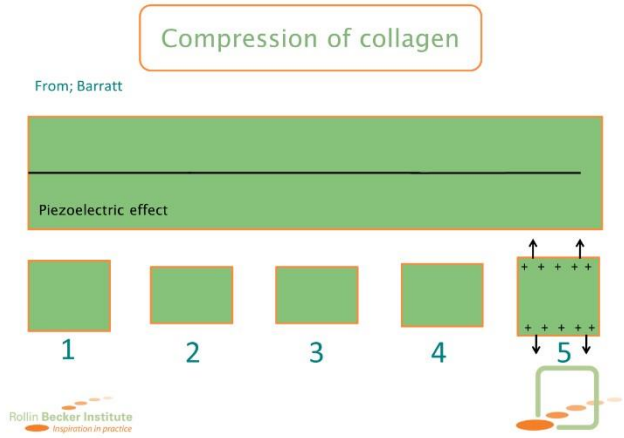
Even though the compression is maintained. Although the piezoelectric trace discharges the polarity change in the collagen remains. So, in compressed collagen this will become negative.



If the collagen is stretched the reverse happens,



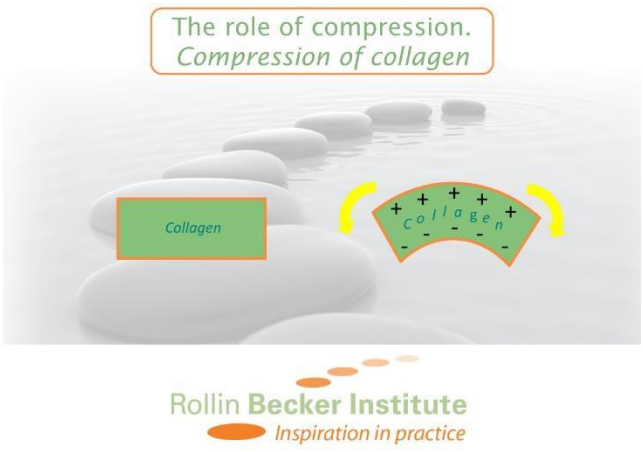
The piezoelectric trace goes the other way then discharges,



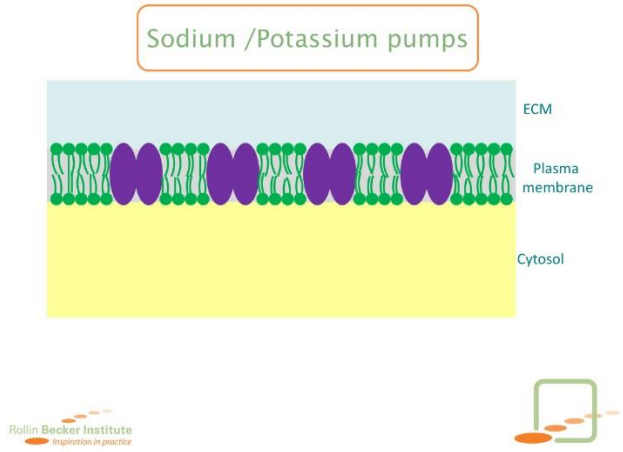
but the polarity is reversed but remains positive in stretched collagen.

Because of tensegrity if you compress collagen it will tension at 90 degrees to it, effectively stretching itself so will become more positive and vice versa so there is a distribution of charge around it .

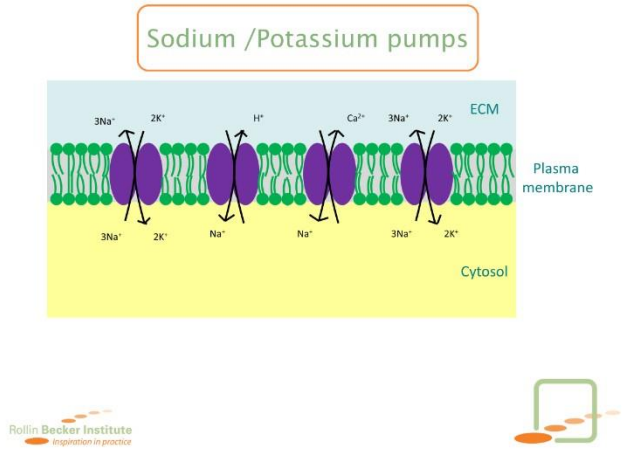
If collagen is bent, it becomes negative on the compressed side and positive on the stretched side...



It looks as though this isn't the complete story, there is some debate as to whether the force required to produce this effect would be too big .ie would gentle pressure associated with cranial produce such an effect. We can use quite a bit of pressure in this approach. BUT it does look like quite gentle mechanical compression can cause a change in the membrane potential of the plasma membrane.



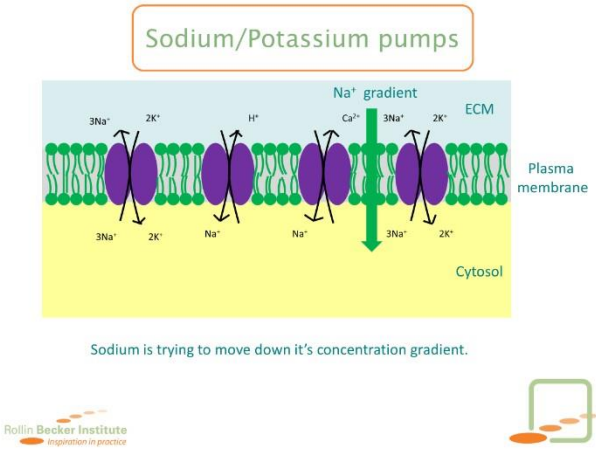
This diagram shows a section of plasma membrane. Here are the bi-lipid layers of the membrane and these purple ovals represent ion pumps sodium/potassium pumps and facilitated sodium calcium pumps. This blue area is the ECM and the cream area is the Cytosol.



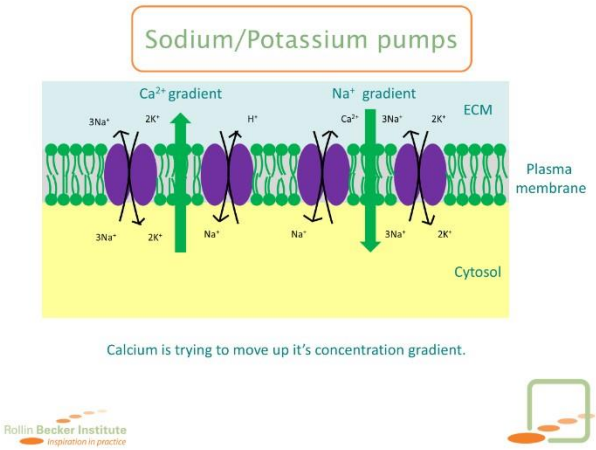
There are the actions of the sodium potassium pumps, and the movement of hydrogen and calcium, the net effect as before is the establishment of an action potential across the plasma membrane.

(Ionic concentrations and concentration gradients between the ISF and ECM are maintained through Na^+/K^+ ion pumps and facilitated Na^+/Ca^{2+} ion pumps.

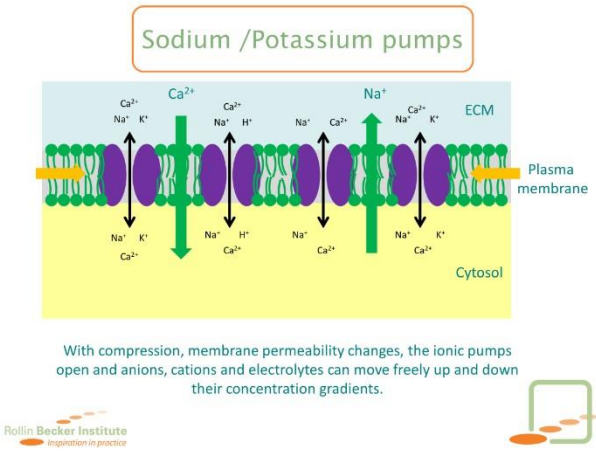
As we know this helps drive the calcium flux in the ECM we have already seen.



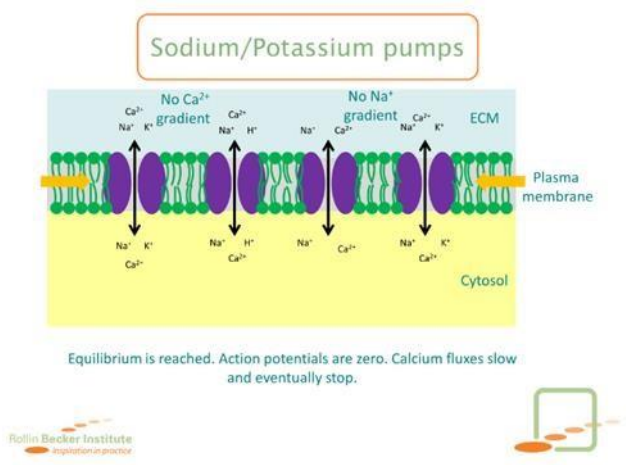
An ionic gradient is produced with sodium trying to move down it's concentration gradient. From high to low concentrations.



Calcium is trying to move up its concentration gradient. Probably to do with the importance of maintaining a super saturated ECM.

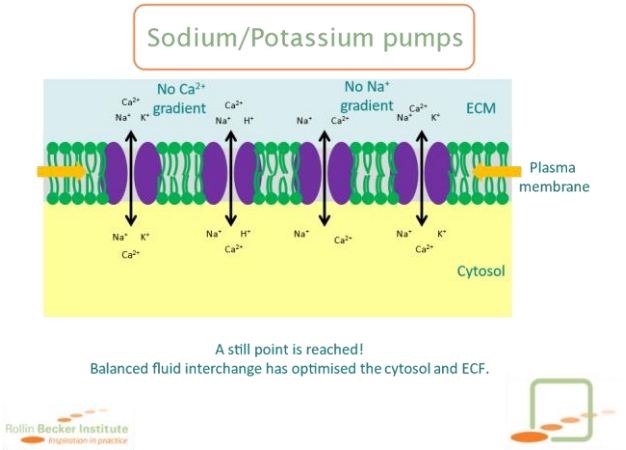


Palpatory contact on the skin and compression may still cause a change in cation distribution via mechanochemical transduction processes via tensegrity mechanical pressure is conducted equally throughout the system which may lead to changes in ionic distribution, changes in plasma membrane permeability and a vasomotive response. The membrane permeability changes, it gets 'more leaky' anyway, but the ionic pumps open and anions, cations and electrolytes can move freely up and down their concentration gradients, a bit like opening the turnstiles at the end of a football match.



An equilibrium is reached. The action potentials are reduced to zero. So, Calcium fluxes slow and eventually stop.

It looks like the calcium fluxes, the TH waves correspond to what we call the Involuntary motion, so if the Involuntary motion stops, what do we call this point, a 'still point'.



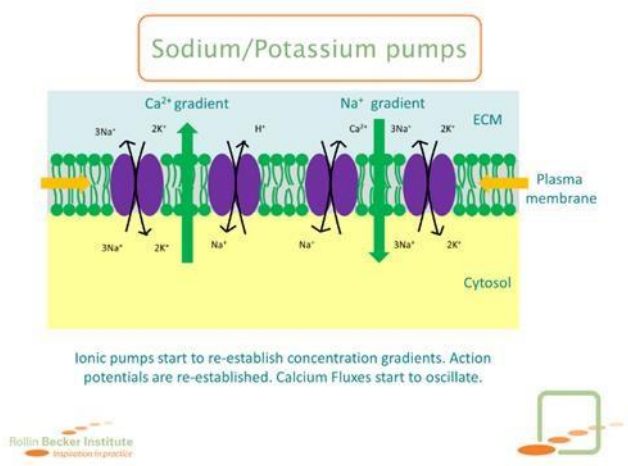
A still point is reached! Balanced fluid interchange has optimised the cytosol and ECF

Compression is still on –

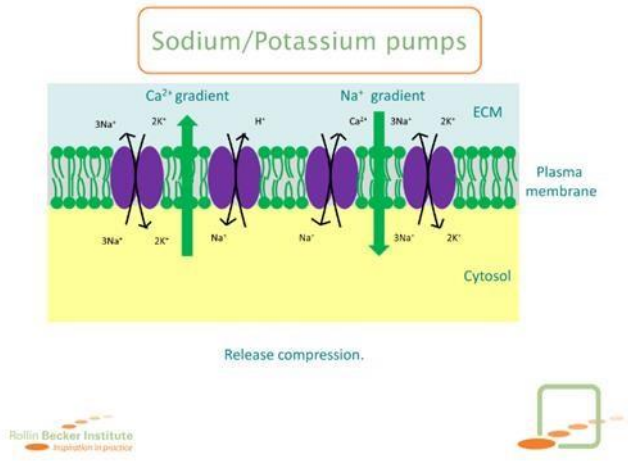
Dr Lee is of the opinion that the Intelligence of the Tide is at the heart of the formation of the stillpoint. How do you tell the uninitiated that the there is a Tide and then go to the next step to say that it has its own inherent intelligence? Science is hard-pressed to do that. Dr Sutherland said he had no explanation for the forces that produce the Tide, except to say that it is an expression of the breath of life.

Dr Lee wrote to me and said 'Perhaps, as you suggest, there is a balanced interchange of elements that come to equilibrium, which manifests as a stoppage of the motion of the tide. This could be observed through research, and is a valuable explanation of the phenomenon. However, the dynamic stillness of a true still point contains something beyond a mere pause in the action. That dynamic quality reveals something beyond a resting state. It is filled with potency. The life force resides within the stillness. The potency lies within the stillness'.

'I think my basic point is that a stillpoint is a normal characteristic of the tide, although, like our own pulmonary respiration, we can also use our will to stop it sometimes. Then, there are the normal sighs that occur without our will. It's generated from within'. Dr P.Lee.



Ionic pumps start to re-establish concentration gradients. Action potentials are re-established. Calcium Fluxes start to oscillate. Everything is a little more optimal, the electro-chemical potentials, the calcium fluxes, so then clinically we



Release compression and note an improved smoother more potent fluid drive.

I imagine a similar thing happens at BMT, utilising the shear potential characteristics of thixotropy, taking it into an easy direction and during the CV4, progressively introducing compression to the collagen matrix.

Or as Rollin Becker said

“We can bring the CSF fluid tide down to that short rhythmic period wherein we reach a stillpoint, a pause-rest period, this is the fulcrum point for the CSF for that moment in time.” “It is at this moment that there is a transmutation from the highest known element that creates an interchange between all the fluids of the body, even within all the living bone cells of the body. As the body responds to this transmutation process and unfolds itself towards more normal functioning, we can note that there is a change in the tidal movement of the total body mechanism as compared to that which we observed at the beginning of our examination.” Dr Rollin Becker ‘Life in motion’ p28

Maybe our explanation goes a small way to explaining the process of still points.

“There is no answer for what happens at a stillpoint”. Dr Rollin Becker ‘Life in motion’ p69

One of Dr Becker best quotes. Hopefully we can gain some understanding of the physiology to help us understand this quote and maybe start to establish what may be happening physiologically at the still point.

Thank you for listening.