COMMENTARY
THE NEED AND OPPORTUNITY FOR BASIC RESEARCH INTO CHIROPRACTIC

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The distinction between basic and applied research was established in the first half of this century. Basic research was regarded as the pursuit of knowledge for its own sake. Scientists sought to unravel the secrets of nature pushing the boundaries of understanding without the limitations of a pragmatic goal. In the modern interpretation basic research tends to be directed in some way, either by the source of funding or by the next frontier of technology that promises to solve problems within a given field. Applied research carries the findings of basic research to a point at which they can be developed to meet a specific professional or community need.

The Chiropractic profession has frequently denounced the empirical approach to analyzing chiropractic practice and philosophy of chiropractic. There seems to a misconception that the application of the basic scientific inquiry to the tenants of chiropractic are at best irrelevant and at worst dangerous to our profession.

This century has seen passionate developments in the art and philosophy of chiropractic practice, without which chiropractic would not have survived, the drive of individual chiropractors to educate and inspire both patients and students has meant survival despite a superficiality of our empirical understanding and catch cry from the field, ‘It Works!’ The future of modern chiropractic continues to depend on how well it is perceived to work in the clinical setting, however, to maximize the potential of the science of chiropractic, clinical observations and clinical trials on their own are inadequate. They only form one of the many stages towards research into chiropractic. We need to also ask, ‘What are the mechanisms that underpin our clinical findings?’

The chiropractic scientific community needs to realize the wealth of research data that exists within parallel professions. We need to acknowledge the data, tools and yardsticks of sciences such as neurophysiology, histology, biochemistry etc. and apply our research questions to established scientific models and methods. In doing so, the task then becomes to frame the chiropractic research question scientifically and this itself will expand our understanding of the methodologies that are applicable to that question.

One may argue that there are many aspects of clinical chiropractic in which a simple cause/effect relationship simply cannot be measured objectively. However, like the art of chiropractic practice, the art of formulating a worthwhile question that begs investigation is fundamental to science. A clinically supported hypothesis that has not yet been adequately proven need not reflect poor science or clinical practice. It simply reflects that much more work needs to be done and that the methodology and the questions at hand need continual critical review. Data from well-designed studies will provoke a wider interest than just the chiropractic community, so results should be published whether or not they support our hypothesis.

If for example we as a profession were to agree that the fundamental hypothesis of chiropractic practice involves “the vertebral subluxation complex (VSC)”, then we as scientists interested in chiropractic could formulate our questions in a manner focusing on the VSC. We could utilize aspects of the basic sciences to address the components of VSC and continually accept the challenge to publish our findings in both peer reviewed scientific and clinical journals.

Molecular research may seem a distance from chiropractic practice, however, recent research into prostaglandin, endorphin’s and substance P relate directly back to our understanding of the histopathological component that is hypothesized in the VSC.

There has been an explosion of literature regarding molecular research in the last decade. Hypotheses have been continually developed to account for the functioning of the nervous system in terms of molecular events.2 The current explosion of information stems not only from increases in sensitivity and resolution of analytical biochemistry but equally from technological advances that permit the observation and quantification of molecular events in functioning, complex and relatively intact biological structures.2

Techniques may range from recording the conductance of single ion channels in patches of membrane and measuring processes in transfected cells or transgenic animals, to imaging receptor-ligand binding, metabolism and blood flow in brains of awake functioning humans.

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The expanded knowledge base of cell metabolism and membrane and organelle biochemistry, has enhanced medical understanding of brain pathology in ischemia, hypoxia, epilepsy, coma, metabolic and nutritional disturbances.

We are encouraged to believe that an increased knowledge of the molecular basis of neurobiology will ultimately lead to an understanding of the coding of experiences that comprise memory. Research in this field enhances our understanding of the molecular structure and dynamics of the cytoskeleton of the cell and regeneration and plasticity of the central nervous system.\(^1\)\(^3\)

The apparently mechanical entity of the subluxation, appears anecdotally to alter adjacent neural function at a molecular/cellular level. However the VSC as hypothesized seems to be more than just a mechanical aberration. Molecular research may provide another vehicle via which aspects of the pathophysiology, myopathy and histopathology of the VSC hypothesis may be elucidated to support our clinical observations.

Mapping of the central projection of afferent fibres from spinal somatic structures,\(^4\)\(^-\)\(^12\) suggests that this neural input may be required for both sensory and mechanical information that contribute to somatosomatic engrams within the local spinal circuitry. In parallel with neurobiological exploration of memory and plasticity within brain tissue, chiropractors would do justice to science by exploring the potential plasticity and engram formation intrinsic to the spinal cord. In doing so, the depth of our understanding of the VSC hypothesis can only increase and highlight the perception of our clinical efficacy to normalize spinal function.

For many years chiropractors have claimed to effect the nervous system via specific spinal adjustments. It is believed that the audible cavitation associated with the adjunctive procedure may influence the mechanically active receptors of spinal joints mediating a change within the spinal cord. However, little is known about joint receptors, particularly those localized within the spine.

Recent evidence has shown that encapsulated mechanoreceptors are a consistent finding in normal human cervical facets.\(^13\) It was surmised that the presence of these receptors indicates that mechanical states of the joint are under the surveillance of the central nervous system. These findings are important to the understanding of central projections of vertebral column afferents and form a basis for further neurophysiological studies aimed at exploring the relationship between vertebral column mechanoreceptors and spinal function.

Research which aims to examine the terminals and tracts of mechanical and sensory receptors in animal models, which may suggest a comparable role in human spinal function, are still needed. It is possible, using neuronal tracers, to follow the nerves from a spinal joint into the spinal cord and examine their terminals and the nerves with which they interact. Having mapped the neurons and their terminals, further experiments could then be performed to discover their effects on the spinal cord as a result of physical changes to spinal joints both in healthy and truly subluxated states.

Experiments that look at the physiological changes of joints as a result of an insult or trauma can build on the knowledge gained from the central projection studies. The neural tissues that mediate inflammatory, biomechanical, spatio-temporal and degenerative changes can be specifically reviewed using stimulation type studies. Hard wiring maps of the central projections from spinal joints, their peri-articular tissues and spinal communicae are slowly becoming established. Studies have been performed looking at the pain processing and relay mechanisms both within the spine and in higher centres like the brain stem and periaqueductal grey regions. These studies have used both chemical and electrical stimulation of superficial tissues like the skin, deep visceral tissues and muscles and have unveiled a new understanding of the relay of painful stimuli.\(^14\)\(^-\)\(^17\)

The time is ripe for stimulation studies for spinal joints and their associated tissues. Indeed our team at the Department of Chiropractic, Macquarie University is currently involved in studies of chemical stimulation to both the zygapophyseal joint and its associated somatic structures. By mapping the intensity of a gene expression, like c-fos, from spinal and brain stem tissues in rats, a model may be developed to demonstrate pain perception from spinal joint structures.\(^18\)\(^-\)\(^19\)

Empirical observations and some clinical trials have shown that conditions such as low back pain, radiating pain,\(^20\)\(^-\)\(^22\) somato-somatic, somato-visceral and even some viscero-somatic responses have been implicated with spinal manipulative therapy.\(^23\)\(^-\)\(^27\) To date the physiological processes that underpin these empirical clinical observations are unclear. Perhaps follow up experiments from these neurosomatic pain studies will allow animal recovery to take place with mechanical fixation of spinal joints simulating the notional VSC, observations of possible pathological somatosomatic and somatovisceral reflexes may be made. This may provide an insight into the site of pain production and perhaps non-invasive rehabilitation potential within spinal tissue.

Chiropractic has been positioned scientifically as a modality for musculoskeletal conditions simply due to the paucity of scientific data that implicates Type O amelioration with this type of care. How do we investigate our role as a health care provider for visceral conditions
that present to chiropractic clinics every day? Viscero-somatic stimulation studies have been around since the 1920’s involving not only cats and dogs but also human observations during abdominal surgery.

The anatomical connections that implicate reflex pathways between the visceras and somatic structures are well described. Conditions like angina pectoris, duodenal ulcer and dysmenorrhoea and their associated pain referral patterns are well known. Neurological labeling techniques are available that could trace somatovisceral connectivity. The existence of somatovisceral reflexes could indicate that visceral efferent fibers may not be exclusive in the initiation of visceral responses. Somatic afferent fibers can also stimulate autonomic nervous system (ANS) efferent fibers, for example, changes in skin temperature lead to cutaneous sudomotor and vasomotor responses. Further, exploration of the role of anxious somatic afferent stimulation on adjacent ANS structures is needed.

Rat experiments have led to a correlation between stimulation of somatic structures like the knee joint or muscles, and resultant changes in heart rate and bladder constriction. Experiments have also been carried out on the vertebral columns of rats. Mechanical forces applied to the vertebrae altered the blood pressure of the animal during the time of application, which normalized after removal of the force. This type of research suggests spinal adjuctive procedures may stimulate afferent somatic fibres and influence the neuronal pool, thereby initiating a somatovisceral reflex. More studies of this nature are needed to continually strengthen the case for our role in the co-management of some Type O disorders.

Clinical evidence further suggests that a neurological change must exist between chiropractic adjustments to spinal conditions and the peripheral nervous system. By sourcing patients with a radiculopathy within a given peripheral nerve distribution and providing a treatment program of chiropractic adjustments, nerve conduction velocity (NCV) can be utilized to demonstrate changes in neural activity both pre- and post-adjustments. Clinical neurophysiological studies are becoming more sensitive to subtle changes in responses as a result of the advent of data acquisition systems and microcomputers. This in turn has led to a rapid escalation in the use of somatic evoked potential’s (SEP), NCV and other evoked potential in the clinical domain.

The neuropathophysiological component of the notional VSC lends itself to stimulation experiments. Clinical trials using NCV’s and supported by animal stimulation studies, are essential in demonstrating whether a correlation exists between the reduction of the VSC and neurological outcomes. Both motor and sensory NCV studies can be performed. The characteristic antidromic effect of the stimulation process should produce a residual F-wave response as a result. The latency, duration and amplitude of the responses may provide information about the neurological implication accompanying a “vertebral subluxation”.

NCV recordings can be taken, for example, before and after chiropractic intervention. Another NCV can be performed on each subject at this time and /or in the weeks that follow. The data generated may be compared to normative data along with inter-group and intra-subject performance. Disorders that can easily be tested by this means include lesions involving the nerve roots or plexus. Windows of opportunity to explore neuropathies of the upper and lower limbs, even the brain stem and cranial nerves are open. The potential of NCV tests, not only in clinical evaluation and support of the VSC hypothesis, but in the study of the compromise of neurological structures and the normalization that occurs as a result of chiropractic intervention has yet to be tapped.

Our chiropractic students demand evidence based teaching at the level expected of a graduate and post-graduate science courses. Our communities expect professional graduates versed in the dysfunctional anatomy and physiology underlying their pain. Insurance bodies are asking for more evidence to support proposed patient management plans. Current medical concepts for health and disease need ongoing challenge. Our colleagues need a structure with which they can support their empirical findings. To meet these challenges we must be pro-active in our enquires and strictly follow the scientific methodology. We must then aim to continually publish our findings initially in non-chiropractic based scientific journals. This ensures that we receive critical analysis of our thinking and methodology applications, thereby establishing our position on an equal playing field amongst the health sciences. Under these circumstances we may even excite non-chiropractic researchers in considering chiropractic concepts that may be a minor extension of their specialized fields. The application of basic research can then be extracted and expanded for clinical consumption. The time is right for our profession to grab the moment and continue to forge new research alliances into the 21st century, without losing sight of our heritage as a healing profession.

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