SYNOPSIS OF DOCTORAL THESIS OF PETER BABLIS
The Effect of Neuro Emotional Technique on Chronic Low Back Pain
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PROLOGUE: BACKGROUND TO THE THESIS:

Unearthing a Rosetta Stone:

The Rosetta Stone was a major archeological treasure that lay undiscovered for centuries. It enabled a dialogue to ensue between civilizations that were millennia apart. Now there has emerged an equivalent—a thesis backed by robust experimental findings of a clinical approach that bridges major gaps between health professions as well as the doctor and the patient. Like the Rosetta Stone, the thesis lay fallow--undiscovered in the archives of a university in Australia. Until now. What this means is that the language and terminology between various means of healthcare delivery—alternative and mainstream—may be reconciled into a common discourse and appreciated by many. This report for the first time takes pleasure in unearthing this groundbreaking, peer-reviewed thesis for the purpose of expanding public awareness of a healthcare approach that reconciles mind and body as well as alternative and mainstream medical approaches to healthcare. But there first needs to be an assessment of the magnitude of the daunting health problem that this work offers to overcome.

The Burden of Low Back Pain: A Perfect Storm:

It can be argued in many parts of the world that healthcare for chronic low back pain represents a Perfect Storm for catastrophe. "Perfect" from an assessment of the American healthcare system made 20 years ago which still holds today:

> "The burden of harm conveyed by the collective impact of all of our health care quality programs is staggering…The challenge is to bring the full potential benefit of effective health care to all Americans while avoiding unneeded and harmful interventions…Meeting this challenge demands a readiness to think in radically new way about how to deliver health care services and how to assess and improve their quality. Our present efforts resemble a team of engineers trying to break the sound barrier by tinkering with a Model T Ford. We need a new vehicle or perhaps many new vehicles. The only unacceptable alternative is to not change."[1]

And "storm" from the fact that nowhere is this problem more apparent than in instances of low back pain. Experts have estimated that 80% of all individuals will have experienced back pain at some time in their lives.[2] The years that people have lived with disability due to back pain have increased by 54% between 1990 and 2015.[3] And the costs? By 2005, total costs of low back pain were $85.9B[4] exceeded only by the 2007 outlay for cancer ($89.0B),[5] 2002 cost of diabetes ($98.1B),[6] or the 2005 tab for heart disease and stroke ($257.6B).[7] The picture was no better in Australia, in which the Global Burden of Disease study established that low back pain was the highest contributor to disability.[8]

Deficiencies in the Medical Management of Chronic Low Back Pain:

Meanwhile, Mark Schoene, editor of an international spine research newsletter from Georgetown University, has recently pointed out that "Spinal medicine in the U.S. is a poster child for inefficient spine care."[9] Small wonder, since spine researchers have stated that medical primary care physicians are lacking in their training for musculoskeletal disorders.[10] Add to this the fact that orthopedic surgeons have been identified as the third highest prescribers of opioid analgesics among physicians in the United Sates.[11] Indeed, it would appear that the "Perfect Storm" analogy for chronic low back pain care holds water, if not gale force winds, as well.

The Chiropractic Alternative:

Thus it would occur to many that the healthcare profession most closely associated with back pain and spine care is chiropractic. Indeed, the research accomplishments addressing chiropractic care were sufficient to earn government recognition of spinal manipulation as one of the two most efficacious means of treating low back pain as early as 1994.[12] Just 10 years later, European guidelines for the management of chronic nonspecific low back pain included courses of manipulation as a recommended treatment option.[13]

But from its origins in 1895 with D.D. Palmer's original focus on magnetic healing,[14] chiropractic identity has been grappling with the challenging task of keeping up—not only with clinical and scientific observations, but also with political trade winds involving public perception and the marketplace of healthcare.[15] Writings from D.D. Palmer made references to displacements of bones, muscles, and ligaments, such that a popular but often misinterpreted concept grew that doctors of chiropractic dealt with "bones out of place" with the locus of such derangements residing in the spine. This led to the widely held view that chiropractors were consigned to back pain treatment and little else, reinforced by a consensus statement by the Identity Consultation Task Force at the 2005 World Federation of Chiropractic that the spine represented the profession's brand platform.[16] This was to mean that chiropractors were to be regarded as spinal health care experts in the health care system.

Not so fast. The most recent meta-analysis of 47 randomized controlled trials involving 9211 participants concludes that spinal manipulative therapy "produces similar effects to recommended therapies for chronic low back pain, whereas SMT seems to be better than non-recommended interventions for improvements in function in the short term."[17] In other words, the traditional clinical trials overall seem to have produced only modest beneficial results for chiropractic intervention for low back pain, despite international recognition and credentialing. The neurological researcher Niels Nilsson some years ago lamented that clinical trials always seemed to produced greatly diminished results compared to what was experienced in the doctor's office.[18]

The essence of what D.D. Palmer conveyed over 120 years ago was that the spine was perceived as a dynamic entity hard-wired into the nervous system, such that the latter *network* and actual scope of practice of the profession would be overlooked. In other words, there would be a rejection of the framework in which chiropractic actually was conceived, as expressed by Palmer:[14]

> "Life is the expression of tone. In that sentence is the basic principle of chiropractic. Tone is the normal degree of nerve tension. Tone is the expression in function by normal elasticity, activity, strength and excitability of the various organs as observed in a state of health."

Therefore, this discussion turns to the integrity of the nervous system and its disorders which provide the pathway by which chiropractic communicates with the entire body and all its organ systems. The challenge is to optimize those pathways in order to ensure homeostasis, healing capacity, and optimal health.

Enrichment: The Biopsychosocial Model:

So how does one tap into those pathways? Rather than simply relieving pressure on the nerves as early chiropractic might have envisioned, one addition would be to consider the role of the mind as well as the body. Debates concerning the interaction of mind and body have endured for decades and have obvious relevance in health and healthcare. The interaction between the physical and psychosocial components of the disease was formally developed by the German psychiatrist George Engel in 1977, who stated that "neglect of this important dimension of the physician's education lies at the root of frequently voiced complaints by patients that physicians are insensitive, callous, neglectful, arrogant, and mechanical in their approaches." This was formally christened as the biopsychosocial (BPS) model.[19] Over time, the BPS model has gained widespread acceptance and adopted by the World Health Organization in 2002.[20]

Low back pain enters the picture when one considers the conclusions of Gordon Waddell in 1996, who stated that, despite greater knowledge expertise and health care resources for spinal pathologies, chronic disability for low back pain was rising exponentially in western society. And despite differences in health care delivery systems and treatment availability in the United States and the United Kingdom, there was little difference in clinical outcomes.[21] Clearly there was a missing element in effectively managing chronic low back pain.

At least one of those elements emerged with research at the end of the 20th century. Drawing from the description of stress as a physiological adaptation by Selye in 1936, [22] researchers established in the late 20th century that there was a clear link between psychological variables and both back and neck pain. Stress, distress, or anxiety as well as mood and emotions, cognitive functioning and pain behavior were all found to be significant factors in generating pain.[23] This led Waddell to observe that the coexistence of chronic stress and chronic pain suggested that stress reduction needed to be included in the treatment of chronic non-specific low back pain.[24]

Further enrichment: Introducing the Neuro Emotional Technique:

It was only logical, therefore, that the BPS principle should have been embraced in the effort to increase the effectiveness of treating low back pain. Fittingly the Neuro Emotional Technique (NET), as conceived by Scott Walker, combined aspects of psychological principles, traditional Chinese medicine, and such physical medicine interventions as manipulation. Its hypothesis was that unresolved stress or emotional pressure could be a factor in maintaining a chronic or recurring condition.[25, 26] The intention was to break the cycle of chronic pain and emotional reaction that tended to exacerbate the pain in a vicious cycle.[27] This was explained in other terms as the "neuromatrix," a neurological signature that is triggered when pain is perceived. With prolonged stimulation over time, less sensory input is needed to produce pain sensation; i.e., the neuromatrix has become sensitized.[28] Furthermore, pain sensations may persist long after the removal of the original pain producing injury or stimulus.[29]

Physical therapies in themselves may include elements of spinal manipulation, physiotherapy, and massage. Psychotherapies include the range of mind therapies from counseling to psychiatry. Principles of these two approaches are a part of NET. But there is yet another component to NET which underlies these interventions. This involves the vast network of chemical events that accompany stressful events, even to the extent that when the stressor is no longer present, the *recollection* of the past stress-related event is sufficient to recreate the same type of chemical conditions in the body.[30] In other words, the neurochemical change that occurs in stress has a lasting effect upon patients that has the potential to hinder the patient's ability to resolve current health issues.[25] The chemical carriers of this information are known as neuropeptides, such as glucagon-like peptide-1 and outer-membrane porin as well as their receptors.[31] Recognized as informational molecules, these neuropeptides carry complex messages throughout the body. Should a link exist between chronic low back pain and emotional stress, it is likely that neuropeptides are a vital component of that link.

Still another element in NET is immune function. Beginning with Ader and Cohen's demonstration that immune reactions could be conditioned,[32] the study of interactions among behavioral, neural, endocrine, and immune function was launched as a coalition of these processes and called psychoneuroimmunology (PNI). This established the principle that the nervous and immune systems are components of an integrated system of adaptive processes, creating a paradigm shift in which these systems were no longer viewed in isolation.[33] In particular, PNI has been applied to understanding disease processes in greater detail, such that it has focused on the use of immune markers and pro-inflammatory proteins known as cytokines as indicators of immune status, and therefore addressing the state of health. Like the stress response, the inflammatory reaction is a crucial element of survival and meant to be tailored to the stimulus and time. A full-fledged systematic inflammatory reaction leads to the stimulation of four major programs: (i) the acute phase reaction, (ii) the sickness syndrome, (iii) the pain program, and (iv) the stress response—mediated by the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system. Indeed, over the past 20 years, numerous studies have documented complex interactions between the brain, immune system, and systemic inflammation.[34] With NET, therefore, we now can couple those interactions to pain and chronic stress.

Portions of all these elements are blended together as shown by the Venn diagram in FIGURE 1:

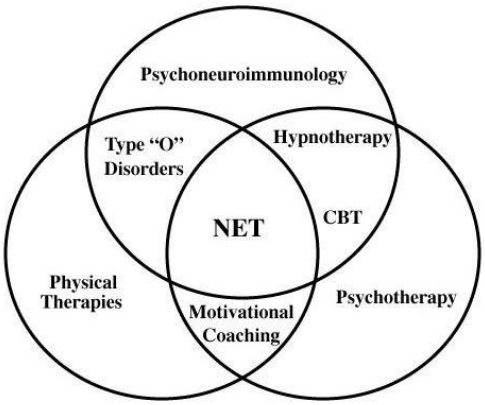

FIGURE 1: The inter-relationship between physical therapies, principles of psychological therapies, and psychoneuroimmunology. Type O disorders are non-mechanical conditions which replicate the symptoms of common musculoskeletal disorders. CBT refers to principles of cognitive behavioral therapy.

An important element of NET is its recognition of the most progressive elements of evidence-based medicine. What once began as a slavish adherence to the peer-reviewed literature as the only criterion for what constituted rigorous medical "evidence," there has been an inexorable march to a tripartite model—first consulting the peer-reviewed literature, then incorporating the expertise and clinical judgment of the physician,[35] and then finally embracing the expectations and values of the individual patient.[36] In concrete terms, it is therefore possible to demonstrate that patient expectations are a major factor in determining clinical and functional outcomes in patients with low back pain caused by disc herniations.[37,38] This provides the perfect introduction to a groundbreaking thesis recently produced by a doctoral student.

THE THESIS OF PETER BABLIS:

Overview:

In 2014 Peter Bablis, Ph.D., B.Sc., Grad D.C. D.Ac, completed a doctoral thesis at Macquarie University that stands out as the most comprehensive review and experimental demonstration of all of the elements described above to date.[39] Its massive span includes:

1. Painstakingly detailed overviews of the backgrounds of:
   a. The incidence and burden of chronic low back pain.
   b. Pain mechanisms and pathways.
   c. Stress mechanisms and pathways.
   d. The biopsychosocial model.
   e. Each of the elements incorporated into NET.
2. An equally detailed overview of the backgrounds of each of the outcome measures employed in a randomized controlled trial:
   a. Pain (Quadruple Visual Analog Scale):
      1] Current pain level.
      2] Mean pain level.
      3] Best (least) pain level.
      4] Worst (most) pain level.
   b. Disability (Oswestry Disability Index).
   c. Quality of Life and Functional Capacity (Short Form 36):
      1] Physical function.
      2] Role physical.
      3] Bodily pain.
      4] General health.
      5] Vitality.
      6] Social function.

7] Role emotional.
8] Mental health.
9] Physical Component Score.
10] Mental Component Score.

d. Physiological blood markers related to inflammation:
1] C-reactive protein.
2] Tumor necrosis factor α.
3] Interleukin-1.
4] Interleukin-6.
5] Interleukin-10.

3. A pilot (feasibility) trial to work out the logistics of a full randomized trial.
4. A full Phase II randomized controlled trial involving 173 patients after randomization.
5. Follow-up assessments at 3 months for pilot study and 3 and 6 months for the full trial.
6. Discussion of results:
   a. Comparisons with earlier studies.
   b. Alternate explanations of the results.
   c. Strengths of the current study.
   d. Limitations of the current study.
7. Unanswered questions and proposed future research.

Experimental Summary:

Participants with low back pain of at least 3 months' duration were recruited into a randomized, blinded, placebo-controlled study conducted in a single clinic in Sydney, Australia. Neuro Emotional Technique (NET) or sham treatments at the rate of two per week for 4 weeks were applied in both the main trial and a preceding pilot (feasibility) study. Patients in the pilot study were followed at 1 and 3 months after a month of active or sham treatments. The ensuing main study involved a month of active or sham treatments, after which the experimental group was randomized once more into a second phase study, splitting the participants into either a "maintenance" group which continued to receive NET treatments at the rate of one per month for the remaining 5 months, or a "non-maintenance" group which received no further intervention. Both sham and active groups were evaluated for all outcome measures at the one, three, and six month marks. This second phase was conducted in order to investigate whether placing patients on continuing care gave any benefit or additional benefit. Baseline demographic data of both the NET and sham cohorts was closely matched.

The results of the trial were, as follows. Unless noted, results represent the mean values obtained:

a. 0-1 months:

FIGURE 2 indicates that, in the 1 month following the commencement of the NET or sham interventions all benchmarks (total of current (Q1), mean (Q2), best (Q3) and worst (Q4) scores on the quadruple visual analog scale [VAS Q1-Q4], Oswestry, C-reactive protein [CRP], tumor necrosis factor α [TNF-α], and interleukins 1, 6, and 10 [IL-1, Il-6, and IL-10]) responded to the NET intervention with statistically significant differences compared to the placebo group Clinically significant differences were obtained as well regarding the VAS Q1, Q2, Q1-Q4, and TNF-α markers.

FIGURE 3 shows that, in the 1 month following the commencement of the NET or sham interventions statistically significant improvements in all 10 dimensions of the quality of life (SF-36) responses were obtained by the NET intervention compared to the placebo cohort. Clinically significant differences were obtained in all dimensions as well except the mental health, mental component, and physical component scores.

b. 1-3, 3-6, 1-6 months:

For VAS Q1-Q4, Oswestry, CRP, TNF-α, IL-1, IL-6, and IL-10, there were no statistically or clinically

significant changes between 1 and 3 months, 3 and 6 months, and 1 and 6 months for either the NET or sham interventions. For the Bodily Pain, General Health, Vitality, Social Function, Physical Component, and Mental Component scores, the NET but not the sham group achieved norm status.

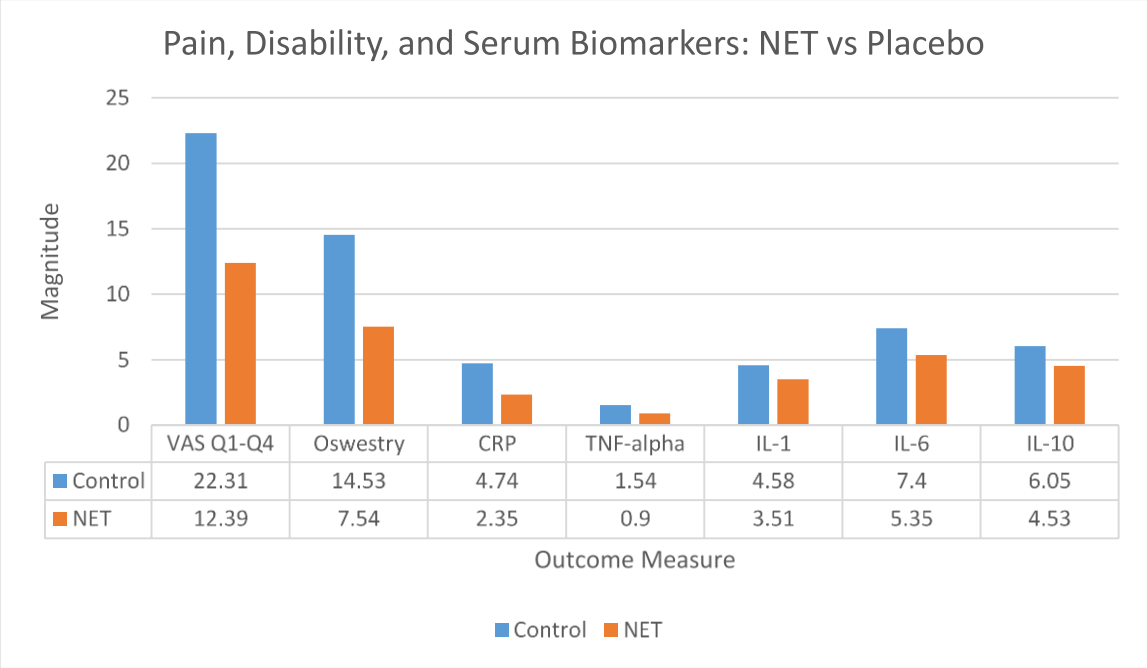

FIGURE 2: Comparisons of seven objective and subjective outcome benchmarks of chronic low back pain patients at 1 month following commencement of NET or placebo interventions. VAS Q1-Q4 = mean of current, mean, worst, and average visual analog pain scales; CRP = C-reactive protein; TNF-alpha = tumor necrosis factor α; IL-1 = interleukin-1; IL-6 = interleukin-6; IL-10 = interleukin-10.

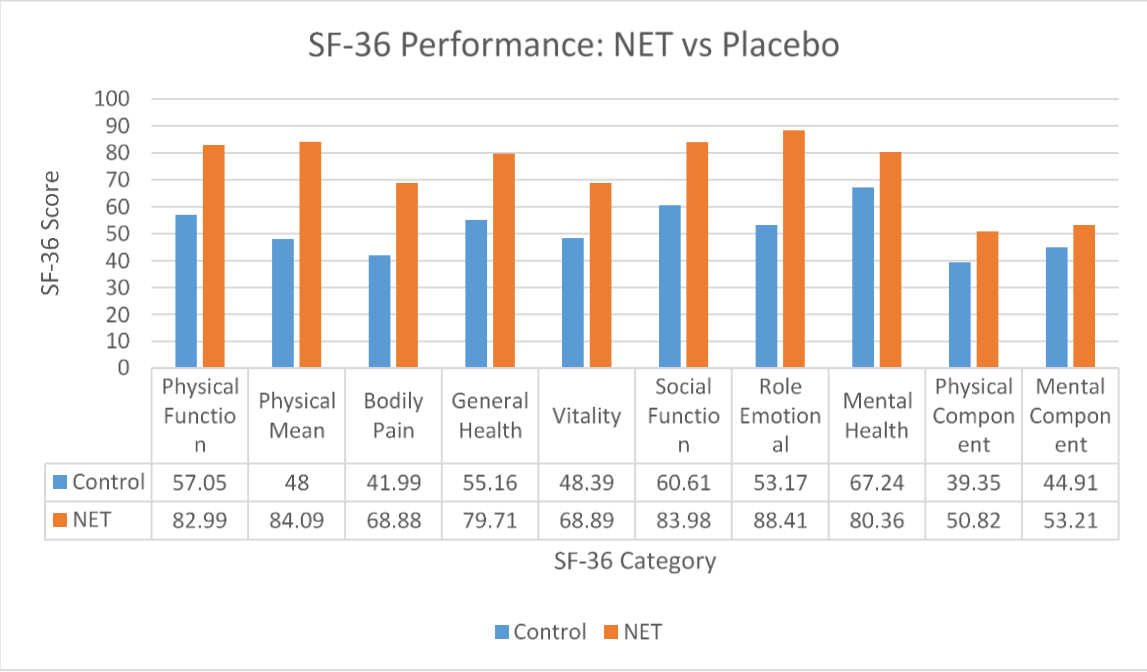

FIGURE 3: Comparison of 10 dimensions of subjective quality of life (SF-36) outcome benchmarks of chronic low back pain patients at 1 month following commencement of NET or placebo Interventions.

A summary of the key primary and secondary results of Bablis' thesis is presented in TABLE 1.

Outcome Measure	Month 1	Month 3	Month 6
ODI	S	S,C	S,C
QVAS Composite	S,C	S,C	S,C
QVAS Current Pain	S,C	S,C	S,C
QVAS Average Pain	S,C	S,C	S,C
QVAS Worst Level Pain	S	S	S
QVAS Best Level Pain	S	S	S
SF-36 Physical Function	S,C,(N)	S,C,N	S,C,N
SF-36 Physical	S,C,N	S,C,N	S,C,N
SF-36 Bodily Pain	S,C	S,C,N	S,C,N
SF-36 General Health	S,C,N	S,C,N	S,C,N
SF-36 Vitality	S,C,N	S,C,N	S.C.N
SF-36 Social Function	S,C,N	S,C,N	S,C,N
SF-36 Role Emotional	S,C,N	S,C,N	S,C,N
SF-36 Mental Health	S,N	S,C,N	S,C,N
SF-36 Physical Component	S,N	S,N	S,N
SF-36 Mental Component	S,N	S,C,N	S,C,N
CRP	S	S,C	S,C
TNF-α	S,C	S,C	S,C
IL-1	S	S	S
IL-6	S	S	S
IL-10	S	S	S

S = Indicates that the difference between NET and sham (placebo control) values with regard to their respective baseline values is significant when subjected to a statistical analysis.
C = Indicates that the difference between NET and sham (placebo control) values with regard to their respective baseline values is significant from the patient's experience (the minimal difference that can be felt by the patient).
N = Achieved a level that is regarded as falling within a clinically normal range (normative value).

TABLE 1: Composite of Outcome Measures, NET vs. Sham at 1, 3, and 6 months.

None of the subjective or outcome measures revealed any significant statistically or clinically significant differences between the maintenance and non-maintenance cohorts.

Adverse events were extremely rare, involving only 5 out of the 171 patients participating with mild symptoms resolving within 2 weeks of the trial interventions without recurrence.

The conclusions of the main trial were as follows:

1. For pain outcomes, NET treatment conferred statistically and clinically significant benefits over the placebo treatment following one month of interventions.
2. For disability outcomes, NET treatment conferred statistically significant benefits over the placebo.
3. After one month of treatment the maintenance and non-maintenance NET groups maintained the clinical improvement for all outcome measures but did not further improve, while the control group remained unimproved from its baseline level.
4. For tumor necrosis factor α, both statistically and clinically significant improvements were observed in the NET treatment group compared to the control group.
5. For C-reactive protein, both statistically and clinically significant improvements were obtained after 3 and 6 months of treatment in the NET group compared to the control group.
6. For interleukin-1, interleukin-6, and interleukin-10, levels were statistically but not clinically reduced over the course of the trial.
7. However, at one month, for all the blood markers (tumor necrosis factor α, C-reactive protein, interleukin-1, interleukin-6, and interleukin-10), there were striking reductions of the percentages of patients in the NET group compared to the control group that lay outside of the normal clinical range. This is illustrated in FIGURE 4:

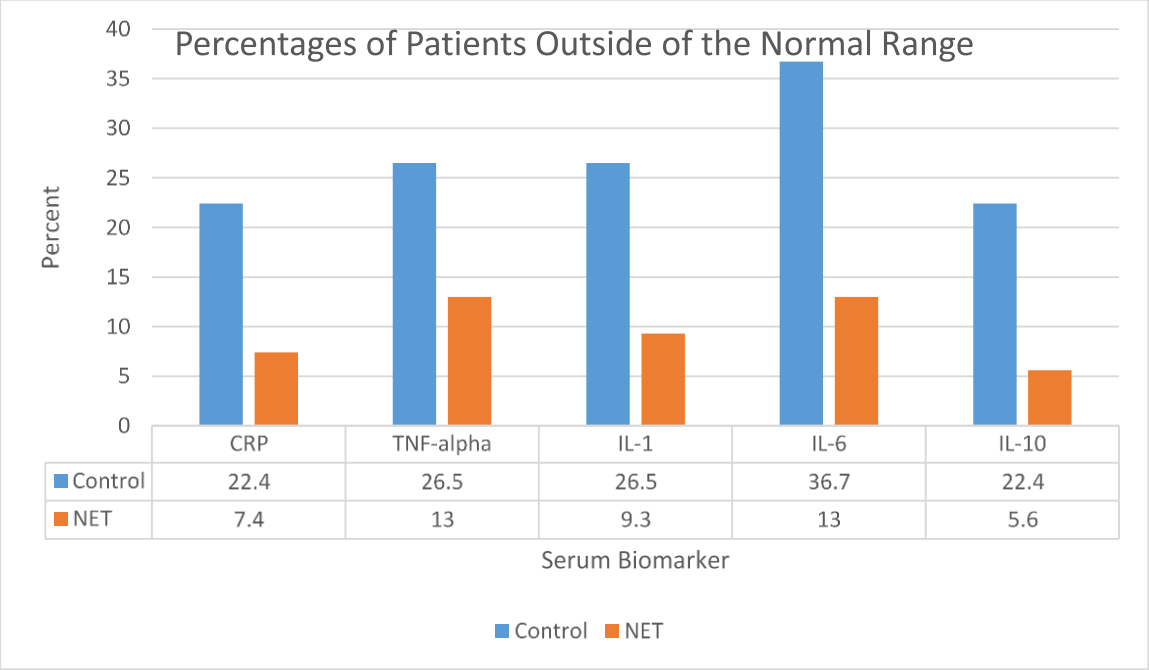

FIGURE 4: Changes in the percentages of chronic low back pain patients whose blood serum levels were outside pf the normal range after 1 month of NET or placebo interventions.

<u>Perspectives on the Neuro Emotional Technique</u>:

Neuro Emotional Technique has been recognized as a safe, gentle, and effective mind-body methodology applied to correct physical and emotional imbalances. It was designed to assist in the natural healing process by discharging unresolved emotional issues and their harmful effects. According to the technique's founder,[25] the syndrome pattern unique to each individual that is called the Neuro Emotional Complex contains the following elements:

1. A specific biomechanical distortion of the spine that contributes to poor function.[39]
2. A specific emotion.
3. A conditioned response, a predisposition for the generalization of stimuli, and a resistance to the extinction of the conditioned response.
4. An acupuncture phenomenon: meridian imbalance and active pulse point.
5. A muscle that displays a specific reaction to a muscle test (facilitated or inhibited).
6. A specific point on the body along an acupuncture meridian that is used as a location to apply a physical stimulus.
7. An invested emotion and/or feeling and often recallable memory of a past significant emotional event.
8. A vulnerability to suppression, repetition compulsion, and re-stimulation.

The actual components of NET itself were proposed by Walker in 2006:[25]

1. Muscle testing: An emotional trigger is proposed to alter the results of a muscle test, such that a muscle that initially tested as strong could test as inhibited (weaker) when the patient is presented with an emotional trigger.[27] The muscle test is viewed as the primary diagnostic monitoring test to assess an emotional reaction to a simple (benign) stimulus.
2. Physiological basis of emotions: Informational molecules including neuropeptides and hormones are regarded as carriers of emotion which permeate the entire body.[40, 41] The limbic system of the brain is particularly rich in neurotransmitter content, such that their secretion could help to explain how emotions are expressed throughout the body and how the mind and body are intimately connected.[40]
3. Pavlovian responses: While conditioning is common place and normal, the fading or elimination of that response, which is known as extinction, is also normal. When extinction fails to take place, NET seeks to facilitate the individual's ability to bring this process back to normal.
4. Correlations between emotions and the meridian system used in traditional Chinese medicine: The links between emotions and acupuncture meridians have been established in Chinese medicine for thousands of years. An example is the link between "Anger" and the Liver meridian.[42] While these links are conjectural in underlying the energy concepts in Chinese medicine and NET, they have yet to be shown as having a basis in fact. Within the NET framework, it is proposed that engaging the body's meridian energy system as conceived in the traditional Chinese medical model[43] in the cognitive-emotional processing of an event facilitates an expedited resolution of the event.
5. Repetition compulsion: This refers to a concept established by Freud in that once a person has become emotionally traumatized (and often conditioned), that individual will non-consciously seek to repeat a like trauma or response to that trauma in the future. The dynamic remains theoretical, yet to be scientifically validated.
6. The role of memory: Aspects of memory of a traumatic event are stored in the brain and body, which encode and can (upon stimulation) replicate the physiology that occurred at the time of the event.[44]
7. Semantic responses: Cognitive challenges as well as simple stimuli produce physiological responses in the body. An example would be if a traumatic event occurred at a circus, such that the mere mentioning of the word "circus" evokes similar stressful physiological responses that occurred at the actual event. In NET, semantic statements are used to evoke physiological reactions that are similar to the events to which they are related.

The limited quantity of previous research included proposals of models, case and observational studies, and later work embracing designs of randomized controlled trials. None, however, have embraced chronic low back pain until the production of Bablis' thesis. A literature review by Pollard assessed the importance of biopsychosocial issues to chiropractic practice, arguing that it was only with the appropriate inclusion of mind-body approaches to management that the full impact of pain and disease could be addressed. It was an obvious invitation to chiropractors to incorporate this approach in their practice.[45] This was accompanied by a literature review on the potential value of co-management of depression in chronic low back pain sufferers, which held that adding psychotherapy to physical therapy would be of benefit. Neuro Emotional Technique was cited as a type of technique that incorporated principles of both of these approaches.[46]

In actual field tests, Monti laid the groundwork in 1999 by demonstrating with a computerized dynamometer that motor power in 89 heathy college students was sensitive to a person's reaction to incongruent semantic statements.[27] With regards to muscle testing, (i) good interexaminer reliability was demonstrated for the deltoid and psoas muscles;[47, 48](ii) the ileocecal valve test (involving stimulation of a point on the abdomen) was validated and correlated with the presence of chronic low back pain;[49] and (iii) manual muscle testing was validated as a diagnostic procedure for distinguishing phobic and asymptomatic patients.[50]

Moving toward a more rigorous experimental design, Karpouzis, Pollard and Bonello outlined a placebo-controlled, double-blind randomized trial design using NET for children diagnosed with attention deficit hyperactivity disorder involving two treatments per week for one month and one treatment per month for six months. Control participants were to receive a non-therapeutic version of the NET procotol.[51] A second study outlined an NET protocol in a randomized controlled trial applied to independently diagnosed and stable hypothyroidism sufferers.[52] An actual trial was conducted with 60 participants with neck tenderness who received a short course of NET involving a single treatment and post-test three days following, while the control group received a sham NET protocol. The NET group showed that pain (visual analogue scale) and trigger point (pressure gauge algometer) sensitivities improved significantly when compared to the control group. However, patients were not randomized, and sample size calculations were not undertaken.[53] A small spider phobia pilot study involving 15 randomized participants showed recoveries in anxiety-subjective distress and fear and avoidant behavior in the NET group compared to a wait list control. However, the difference between the groups for general anxious symptomatology and heart rate was not statistically significant.[54] Another pilot study involving pregnancy-related low back pain and patients randomized into exercise, spinal manipulation, and NET groups found clinically meaningful reductions of symptoms in all three cohorts but no difference between the groups.[55] Yet another pilot randomized control trial sought to determine the effect of NET upon general flexibility of 45 healthy participants. A comparison of three groups (NET, stretching, and passive control) found improvements in all three but no evidence of a difference between the cohorts.[56]

With the patient becoming more and more a major component of what is considered true "evidence-based medicine,"[57] case reports and case series play an increasingly important role in directing our attention to new approaches in healthcare—including NET. A summary of NET case reports follows:

1. Two patients with elevated serum cholesterol experienced 23% and 28% clinically significant decreases of this metabolite after undergoing a mind-body spinal manipulation procedure.[58]
2. Two patients suffering hypothyroidism registered improvement following a course of NET therapy.[59]
3. Two cases of anovulation were resolved after a course of NET therapy.[45] This was followed by two additional patients experiencing the resolution of anovulation following NET therapy with their pain ratings on a visual analog scale decreasing from 10 to 0 out of 10.[60]
4. A 13-year old boy with intense separation anxiety from his mother showed profound improvement following the addition of 8 NET treatment sessions to his usual care management program.[61]
5. In 7 patients suffering traumatic stress following cancer related experiences, three NET treatments were followed by statistically significant improvements in four validated outcome measures of stress.[62]
6. In two elite power weight lifters, subjective resolutions in cognitive anxiety and salivary hormone profiles followed a 30-minute session of NET that focused on the athlete's concerns regarding their upcoming competition.[63]
7. An uncontrolled cohort study of 188 consecutive patients with both musculoskeletal and non-musculoskeletal complaints showed strongly significant improvements in the Distress and Risk Assessment Method (DRAM) scores after NET treatment.[64]

Despite the fact that these observations lacked control groups, blinding, or statistical analyses, they not only provide the framework and impetus to conduct future controlled studies, but also present evidence in real-world settings that could not be precisely duplicated in traditional clinical trials.

Significance of Outcome Measures Employed:

Much of the power of Dr. Bablis' thesis lies in its employment of both subjective and less commonly used objective (physiological) outcome measures to document the efficacy of an NET intervention. Orthopedic

maneuvers upon physical examination were ruled out due to inherent problems with reliability, validity and predictive values.[65, 66] The outcome measures employed in the thesis were the following:

A. A Modified Oswestry Disability Index (ODI):

The most commonly recommended condition-specific outcome measure for assessing disability due to spinal disorders is the modified Oswestry Disability Index (ODI).[67-71] Options in each category are graded from easy-to perform to virtually impossible. Each of the 10 sections has 6 divisions, ranked from 0 (no disability or pain) to 5 (maximum disability or pain). The numerical values for each of the sections are added, divided by 50 (the maximum score of all 10 sections), and multiplied by 100 to yield a score in percentage. The score is interpreted as follows:

0-20%: Patient can cope with most living activities. Usually no treatment is indicated.

21-40%: The patient experiences more pain and difficulty with sitting, lifting, and standing. Travel and social life more difficult with possible disability from work. Personal care, sexual activity, and sleeping are not grossly affected, and the patient can usually be managed by conservative means.

41-60%: Pain remains the main problem, activities of daily living are affected. These patients require a detailed investigation.

61-80%: Back pain impinges on all aspects of the patient's life. Positive intervention is required.

81-100%: The patients are either bed-bound or exaggerating their problems.

The reliability[70] and sensitivity[69] of the ODI has been confirmed. The minimum clinically important difference (MCID) for the modified ODI has been reported to be 6 points (12 percentage points).[72, 73] In Bablis' thesis, the modified ODI was selected as the primary outcome measure.

B. The Visual Analog Scale (VAS):

First published in 1921,[74] the visual analog scale consists of a 100 mm line with opposite poles (No Pain at point 0 and Worst Pain Possible at point 10). With patients indicating the location on the line corresponding to the intensity of their experienced pain, a measurement in millimeters is then taken to assess how far along the line the responder has indicated his or her pain level.

The reliability of the VAS has been established in studies of chronic pain. A VAS change in the order of at least 2.0 units (20 mm) or greater is considered to be of clinical significance in a population of low back pain sufferers.[75, 76] A more expansive form of the VAS, validated for clinical research on low back pain, captures a broader spectrum of the responder's pain experience by posing four questions: (i) current pain, (ii) average pain level, (iii) worst pain experienced, and (iv) best (least) pain experienced. The broad support of the Q-VAS in the literature established it as a secondary outcome measure in this thesis.

C. Short Form 36 (SF-36):

Originating from the Medical Outcomes Study (RAND Health Insurance Experiment),[77] the SF-36 is a 36-question generic health status measure that facilitates comparison with normative data. It has become one of the most widely used patient assessed health outcome measures.[78] The SF-36 essentially measures functional health and well-being from the participant's perspective.[79] It is composed of 8 scales using a Likert scale with five response categories ranging from "much better" to "much worse." It is summated and weighted for a total score between 0-100 for each of the scales.[79] Its outcomes are compared to normative data collected in numerous countries, including that in which Bablis' clinical trial was conducted (Australia).[80, 81] Version 1, used in Bablis' thesis, has demonstrated internal consistency,[82] test-retest reliability,[83] good discriminatory power,[84] and good responsiveness and sensitivity to change.[85, 86] The minimum clinically important difference for each of the eight scales is 12 points.[87] The components of the SF-36 displaying their contribution to physical and mental health measures are shown in FIGURE 5.

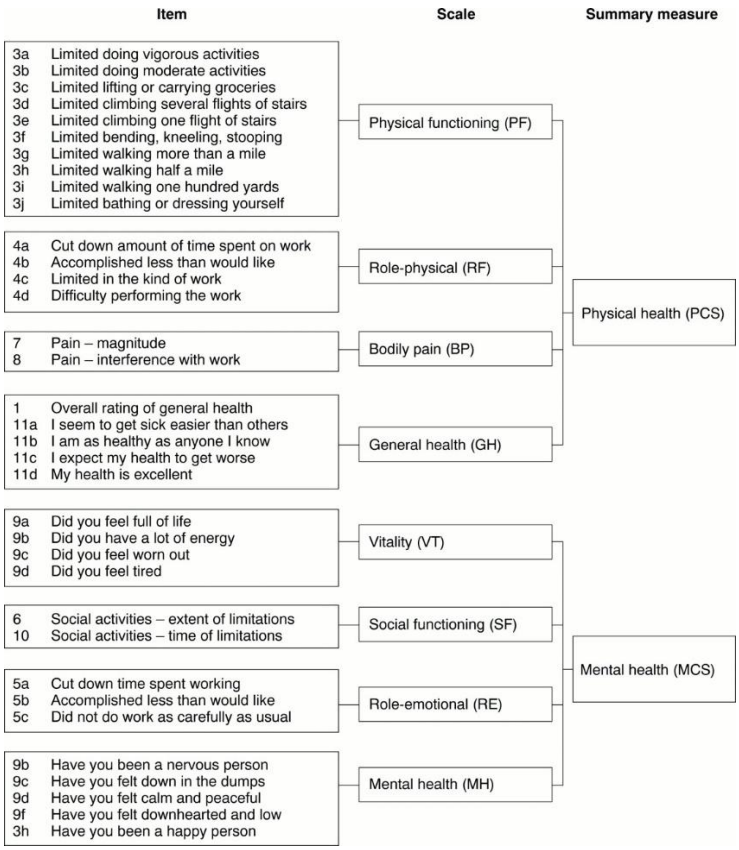

FIGURE 5: The SF-36, version 1, with scales grouped into physical and mental health components

Normative values for each of the scales in an Australian population are shown in TABLE 2:[88]

TABLE 2: Normative Values for SF-36 Scales in an Australian Population.[88]

SF-36 Factor	Mean	Standard Deviation
Physical function	83.6	23.4
Role physical	79.7	35.1
Bodily pain	76.9	25.2
General health	71.5	20.8
Vitality	63.9	19.4
Social function	84.6	22.2
Role emotional	83.7	30.9
Mental health	75.7	16.4
Physical Component Score	50.0	10.0
Mental Component Score	50.0	10.0

The Cytokines:

The cytokines are a group of about 100 small proteins that signal cells to perform a biological function, basically acting as messengers between the cells.[89] They typically have a limited duration of action and operate only over a short distance.[90, 91] While circulating, their tendency is to exist in small concentrations, but they may increase their level 1000-fold when biologically activated.[92] Researchers have used them as markers of organ and musculoskeletal damage.[93] An important distinction between cytokines and hormones is that the latter have targeted effects, while cytokines tend to act in a systemic immunologic fashion. Interleukins, a subclass of cytokines, derived their names from originally being thought to be expressed by white blood cells[94] but now are known to be produced by a variety of cell types.[95] Many of these proteins, including the ones chosen as outcome measures in this thesis, are involved in the acute inflammatory process.

D. C-Reactive Protein (CRP):

C-reactive protein is a serum protein that accompanies inflammation and tissue injury.[96] It is a significant underlying factor in many diseases, induced by the pro-inflammatory cytokine proteins interleukin-1, interleukin-6, and interleukin-17 in the liver.[97] Its contribution to inflammatory diseases including atherosclerosis places it as a marker of cardiovascular risk.[98] Other researchers regard it as a measure of systemic inflammation.[99] Its normal range threshold in serum is 0.0-5.0 mg/L.[39] Because elevated CRP levels have been identified in musculoskeletal conditions[100] and because previous investigations used CRP as an outcome measure in acute and chronic low back pain,[101] it was deemed a potentially important physiological outcome measure and was incorporated in Bablis' thesis. The multiple pro-inflammatory effects of CRP are shown in FIGURE 6:

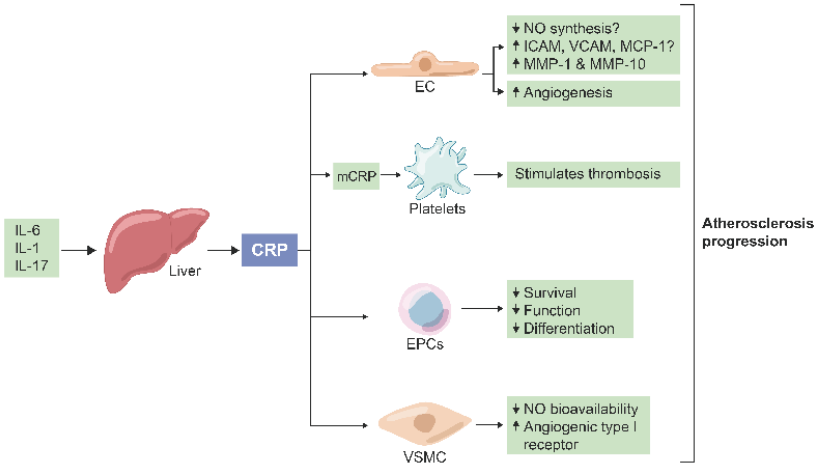

FIGURE 6: Multiple pro-inflammatory effects of CRP. NO = nitric oxide; ICAM = intercellular adhesion molecule; VCAM = vascular cell adhesion molecule; MCP = membrane cofactor protein; MMP = matrix metalloprotein.

E. Tumor Necrosis Factor α (TNF-α):

Tumor necrosis factor α is a pro-inflammatory cytokine that promotes the release of other cytokines (interleukin-1, interleukin-6, and interleukin-8) that promote inflammation.[102] Its own capacity to cause inflammation is achieved by its promotion of fibroblasts to express adhesion molecules, allowing an increased number of these molecules to attach to leukocytes and transport them into joints.[103] Its normal range threshold in serum is 0.00-1.00 pg/ml.[39] In addition to its being associated with musculoskeletal disorders[104] and chronic low back pain in particular,[105] it has been shown to decline in humans subjected to spinal manipulation.[106] For these reasons, it was chosen as a significant outcome measure in Bablis' thesis. The multiple effects of TNF-α are shown in FIGURE 7.

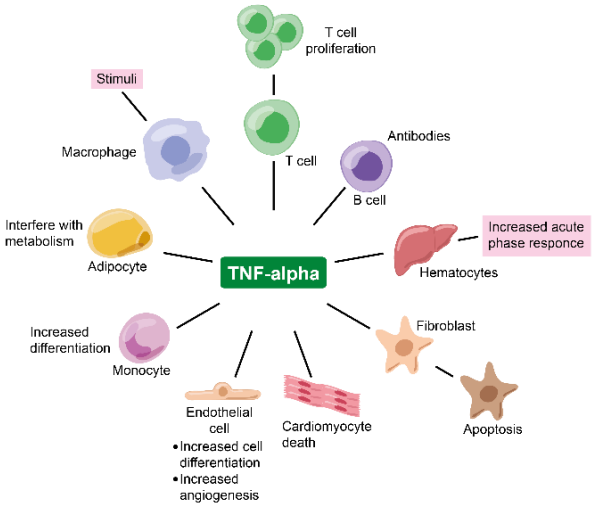

FIGURE 7: Multiple pro-inflammatory effects of TNF-α

F. Interleukin-1 (IL-1):

Interleukin-1 is a protein produced by a variety of cells (monocytes, macrophages, endothelia cells, and activated T cells).[107] Its biological activity depends upon its specific concentrations with higher levels associated with the acute inflammatory response. Its normal range threshold in serum is 0.0-5.0 pg/ml.[39] It is recognized as an important precursor in musculoskeletal disease, including osteoarthritis and back pain—including chronic low back pain.[108] Its role in the inflammatory process has earned its place as an outcome measure in numerous studies,[109] and it has been linked to chronic low back pain in patients--[110, 111] particularly in those with post-traumatic stress disorder.[110] Finally, IL-1 has been shown to be at least temporarily depressed following a thoracic spinal manipulation.[106] For all these reasons, IL-1 was chosen as an ideal outcome measure in Bablis' thesis. The multiple effects of IL-1 are shown in the schematic in FIGURE 8:

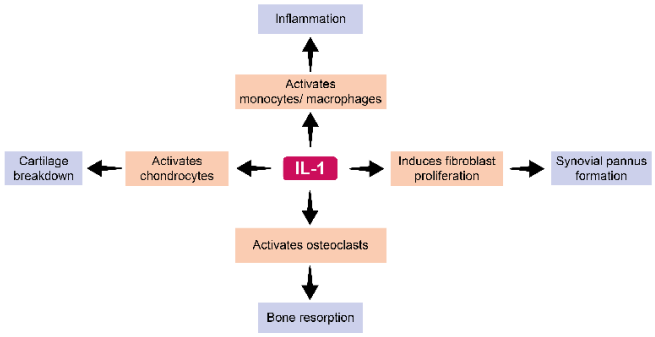

FIGURE 8: Multiple effects of interleukin-1

G. Interleukin-6 (IL-6):

At the commencement of the acute inflammatory process, IL-6 organizes the acute phase responses. If its activity as a pro-inflammatory substance is extended, the acute inflammatory response becomes chronic and recruits immune response mechanisms. Thus, in chronic inflammation, IL-6 is mainly pro-inflammatory,[112] with some caveats.[113] In tendosynovial tissues collected from 41 patients with idiopathic carpal tunnel syndrome at the time of carpal tunnel release, increased levels of IL-6 have been identified.[114] Pro-inflammatory effects if IL-6 include induction of cell growth and proliferation and has been established as a marker of injury severity.

But these effects are mainly confined to an early response, since they are followed by a degree of a compensatory anti-inflammatory effect. Specifically, IL-6 enhances the synthesis of glucocorticoids that possess remarkable anti-inflammatory (and immunosuppressive) properties, while at the same time stimulating the expression of the antagonist of the IL-1 receptor.[113] Thus, IL-6 engages in a balancing act in controlling pro- and anti-inflammatory processes. The normal range threshold of serum IL-6 is 0-8.0 pg/mL.[39] The varied effects of IL-6 are displayed in the schematic in FIGURE 9:

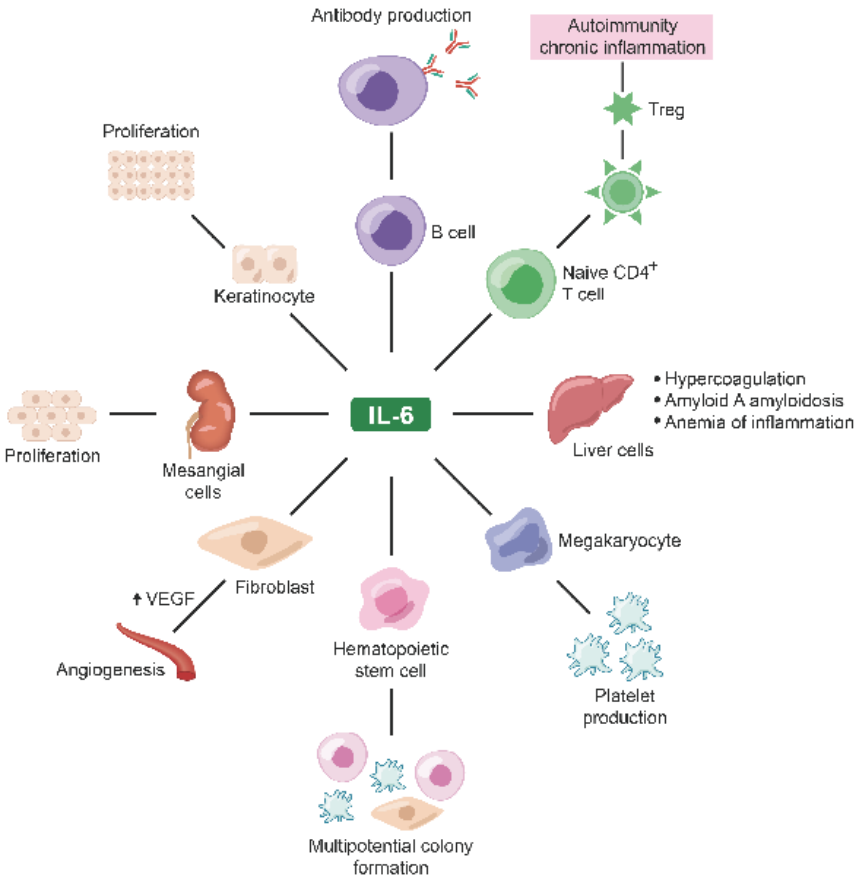

FIGURE 9: Multiple effects of interleukin-6

H. Interleukin-10:

The cytokine IL-10 regulates the biological activities of a variety of immune cells, including monocytes, macrophages, B cells, and T cells[115] when the body is under stress. It strongly inhibits the production of pro-inflammatory cytokines and thus reduces the production of pro-inflammatory mediators.[116] The anti-inflammatory functions of IL-10 extend to virtually every type of acute and chronic inflammatory and infectious diseases. These activities cannot be compensated by other factors, because the deletion of IL-10 in all cells or only in T cells causes excessive inflammation—especially in the gut, where IL-10 blocks inflammations driven by the gut flora.[117-119] The normal threshold level of serum IL-10 is 0-8.0 pg/mL.[39] Several studies have found a role of IL-10 in a variety of conditions, including emotional stimuli, infectious diseases, cancer, transplantation, autoimmune diseases, and acute and chronic inflammatory diseases.[115] The documented suppressive role of IL-10 in inflammatory processes creates a rationale for including this biomarker as an outcome measure in Bablis' thesis, hypothesizing that NET interventions could conceivably raise its level. The multiple anti-inflammatory actions of IL-10 are depicted in FIGURE 10:

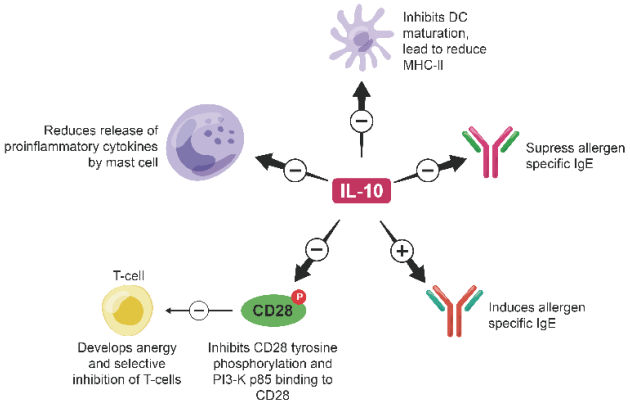

FIGURE 10: The anti-inflammatory pathways of interleukin-10

<u>Analysis of Results</u>:

The NET intervention in the main trial clearly produced statistically and clinically significant improvements in the primary outcome (Oswestry Disability Index), the secondary outcome (Quadruple Visual Analog Scale) and most of the multiple SF-36 indices. For all five blood markers (CRP, TNF-α, IL-1, IL-6, and IL-10), Bablis' interpretation was far more cautious: He stated that all markers showed statistical improvement with the NET treatment (both maintenance and non-maintenance cohorts), but that clinical improvement was lacking—except for TNF-α at the first month and CRP at months 3 and 6. This alone is a significant finding. To add to this interpretation, however, further emphasis has to be placed upon the percentages of patients whose blood marker values lay outside of the normal range with or without NET intervention. Clearly, significant reductions of those percentages appeared in patients who underwent NET therapy, as shown in FIGURE 4.

This clearly raises a far more searching question that remains unanswered: With NET treatments, did the resolution of pain and disability outcome measures correlate with significant changes in one or more of the blood markers *in each individual patient?* As with virtually all traditional randomized clinical trials, we are left with an average—a mixed salad—of outcomes that does not inform us of the progress of each individual patient. Given the overall averages of these outcomes and the magnitude of the changes of all outcome measures, it is probably a safe bet to assume that parallel improvements of pain, disability, and one or more of the inflammatory blood markers were experienced in *some* patients, with the understanding that individual participants remain unidentified. To buttress this argument is the fact that what we are experiencing is a revolution in research paradigms that are more patient-centered.[57] Added to this is a rapidly evolving terminology within orthodox medicine geared to more individualized healthcare known as precision medicine. Here, treatment and outcomes are designed for the individual patient rather than averages drawn from a presumably representative population.[120]

Another important caveat in Bablis' interpretation of clinically significant changes in the blood markers has to do with his selection of normative ranges from which his conclusions are drawn. Presumably these ranges were derived from a representative Australian population matching the demographics of the subjects recruited in Bablis' investigation. Presumably, also, the ranges were derived from the laboratory services and enzyme-linked immunoassay technique (EIA, by Pathlab) employed in this investigation. However, it needs to be pointed out that normative ranges vary considerably from laboratory to laboratory, as shown in TABLE 3:

Regardless, the NET intervention transcends what has been described in the past as the conventional chiropractic adjustment and takes into account a multiplicity of streams of thought and interventions that have advanced healthcare through the ages. It is only with progressive treatments of this nature that one may look back and reflect upon the limitations of previous methods of healthcare.

TABLE 3: Normative Ranges of Various Blood Serum Levels of Inflammatory Biomarkers:

Blood Marker	Normative Ranges	
	Bablis' Thesis[39]	**Sample Literature Value**
CRP	0.0-5.0 mg/mL	<10 mg/mL[121]
TNF-α	0.00-1.00 pg/mL	5-27.2 pg/mL[122]
IL-1	0.0-5.0 pg/mL	10-22.7 pg/mL[123]
IL-6	0.0-8.0 pg/mL	0.5-3.5 pg/mL[124]
IL-10	0.0-8.0 pg/mL	<3.0 pg/mL[125]

In contrast to the subjective Oswestry Disability Index and Visual Analog Scales, clinically significant differences of blood markers have not been determined other than normative ranges. These so-called normative values, however, are subject to wide variations depending upon (i) the extensive demographic features of the population tested, (ii) the assay methodology, and (iii) the laboratory performing the assays. Far more telling are the actual statistically significant *changes* observed in Bablis trial from baseline to post-treatment. These are demonstrated by the population averages and numbers of individuals falling within or outside of the "normative" ranges shown in Bablis' data.

Bablis' own interpretation as to why the *mean values* of three interleukins IL-1, IL-6, and IL-10 remained within normal values both at the commencement and conclusion of the trial was that the patients were not in the acute phase of inflammation but rather the chronic phase. IL-1 and IL-6 are known as potent inducers of the acute phase of inflammation, with IL-10 counteracting at those times.

The fact that IL-10 levels registered a *decrease* rather than the expected increase produced by the NET intervention may initially seem more puzzling. For the same reason as postulated above (study of chronic rather than acute low back pain), the anticipated increase of IL-10 may have occurred much earlier in the back pain episode and was now returning to normal levels with the passage of time. Indeed, a variety of factors capable of reducing IL-10 production as part of an exquisite intracellular control mechanism have been identified and described elsewhere.[126]

More clearly established in this report is the fact that any benefits to conduct maintenance care of NET to sustain improvements in functional status or reduce the level of pain in chronic low back pain sufferers beyond the first month after the initiation of NET treatment is not supported. There were no differences between the maintenance and non-maintenance treatment groups at the end of five months of additional therapy.

Suggestions for Further Research:

The earmark of a productive and provocative research effort is to chart a course for further investigations. That has been amply fulfilled by Bablis' thesis, leading to a proposed roadmap featuring four lines of inquiry, all entailing a randomized, double blind, placebo-controlled clinical trial:

1. As mentioned above, the study should be repeated for a patient population affected by acute rather than chronic low back pain, with the hopes of capturing more clinically striking changes of the interleukins, including an increase rather than decrease of IL-10 stimulated by NET interventions.
2. Changes in the levels of the blood markers should be recorded together with those in pain and disability scales for *each individual patient*, such that the objective physiological outcomes and subjective scales may be more rigorously tied together in order to provide further support for the effectiveness of NET therapy.
3. Additional objective outcome measures other than blood values would shed further light upon the mechanisms of NET therapy. Candidates would be surface electromyographic measurements of the musculature in the lumbosacral area and functional MRI determinations in the brain.
4. The presumed enhancing effects of NET should be tested against traditional chiropractic intervention. The clinical trial study design would include five arms for maximum validity: (i) chiropractic vs sham, (ii) NET vs sham, (iii) chiropractic vs NET, (iv) sham chiropractic vs NET, and (v) chiropractic vs sham NET.

Conclusion:

A breakthrough of historic proportions in the management of low back pain has been achieved by the unearthing of a thesis representing years of experimental studies in conjunction with the Macquarie University in Sydney, Australia. Its author, Peter Bablis, has demonstrated that a unique combination of chiropractic interventions, psychological principles, and traditional Chinese medicine called the Neuro Emotional Technique (NET) produces an improvement of chronic low back pain across a broad spectrum of both subjective and objective health outcome measures. These included pain (Quadruple Visual Analogue Scale), disability (Oswestry Disability Index), Qualify of Life and Function Capacity (10 scales of the SF-36 Scale), as subjective markers, and—possibly of even greater significance—a cross-section of indicators of inflammation sampled from the blood (C-reactive protein, tumor necrosis factor α, interleukin-1, interleukin-6, and interleukin-10). Improvements were seen in the first month of treatment with no significant deterioration or gain 3 and 6 months after treatment. Thus, NET has been shown to serve as a preventive as well as a more effective means of treating a common and disabling musculoskeletal condition. And while the focus and title of this study is on the low back pain plague, this investigation is even more noteworthy in its reporting of the reduction of the inflammatory markers—because we are now witnessing the reduction of risk factors that could lead to such common life-threatening conditions as cardiovascular disease and stroke. In so doing, this study demonstrates the far-reaching effects of an integrated mind/body intervention.

The entire peer-reviewed thesis of Peter Bablis, The Effect of Neuro Emotional Technique on Chronic Low Back Pain, is available at:
https://www.researchgate.net/publication/282120412_The_effect_of_neuro_emotional_technique_on_chronic_low_back_pain

Word count: 7925

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