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# Functional Neuromodulatory Triggers According to Nazlikul Beyond the Classical Interference Field: A Neurophysiological Hypothesis and a 360-Patient Case Series

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**Abstract**

**Background:** The traditional distinction between segmental neural therapy and interference field therapy relies in part on anatomical segment boundaries to distinguish local from distant effects. Engel and colleagues questioned this distinction and proposed the term *neuromodulatory trigger* to reinterpret the interference field in neurophysiological terms. The role of potentially reversible musculoskeletal and respiratory dysfunctions in this framework remains unclear.

**Objective:** To formulate the functional neuromodulatory trigger (FNT) hypothesis, derive testable predictions, and describe manual examination findings and short-term clinical outcomes in patients with persistent symptoms after conventional neural therapy.

**Methods:** A focused narrative synthesis integrated clinical observations with neurophysiological and biomechanical models. The hypothesis proposes that a reproducible functional impairment may generate recurrent or sustained afferent input that helps maintain a sensorimotor or autonomic response beyond its region of origin, even if the impairment arose after symptom onset. In a descriptive series of 360 patients aged 12–84 years, manual examination of the thoracic segments, first rib, diaphragm and sacroiliac joints guided treatment combining neural therapy with mobilisation and, where indicated, post-isometric relaxation.

**Results:** Four mutually exclusive combinations of examination findings were documented in 330 patients (91.7%). Diaphragmatic dysfunction with first-rib restriction was the most frequent combination (105 patients, 29.2%). Complete resolution of presenting symptoms by the end of the third session was documented in 290 patients (80.6%). An approximately 60% improvement was reported in 45 patients (12.5%), and five (1.4%) showed no clinical response. Eight patients (2.2%) discontinued after the second session, and outcomes were unreported for 12 (3.3%). Improvement was maintained at 12 months in all 290 initial complete responders.

**Conclusion:** Recurring functional findings informed treatment selection in this series. The uncontrolled design precluded assessment of the contribution of individual treatment components, and the durability of symptom changes remains unknown. Prospective studies should establish the reproducibility of candidate findings and test whether modifying a specific impairment changes a predefined secondary response, and whether that relationship varies with baseline nociceptive sensitivity.

**Keywords:** Functional neuromodulatory triggers, Interference fields, Neural therapy, Manual medicine, Afferent signalling

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## 1. INTRODUCTION

The treatment of chronic symptoms involves two diagnostic tasks. The first is to identify an underlying structural, inflammatory, neurological, or visceral disease. The second is to determine which modifiable processes sustain the symptoms after the underlying condition has been diagnosed or treated. Both tasks are integral to clinical assessment. Normal imaging findings do not resolve the second question, just as an abnormal functional finding cannot replace the investigation required to answer the first.

This article builds on the integration of manual medicine and neural therapy pursued in my earlier publications [1–4]. Particularly in the thoracic region and pelvic ring, an exclusively site-based approach appears insufficient: movement, breathing, pain processing, and autonomic responses change together, although this does not establish a clear direction of causality. These clinical observations call for a model that respects anatomical relationships while accounting for the dynamics of neural processing.

The study published by Engel and colleagues in 2022 provides a conceptual starting point [5]. If clinical responses can be mediated across spinal segments, spatial distance alone is insufficient to distinguish a segmental response from an interference field effect. This raises a further question for the hypothesis developed here: under defined conditions, can a reversible mechanical or respiratory dysfunction serve as a source of afferent input with effects extending beyond its region of origin?

The concept of the functional neuromodulatory trigger is proposed as a means of investigating this possibility. The term does not denote an established new disease entity, nor is it intended to confer greater significance on every finding obtained through manual examination. Its potential value lies in whether it allows a particular clinical constellation to be described and predicted

more precisely than the terms segmental restriction, trigger point, or nonspecific dysregulation alone.

The clinically relevant distinction is between an accompanying finding and a perpetuating factor. An accompanying finding may coexist with pain without materially influencing its course. A perpetuating factor, by contrast, would need to exert a testable influence on a defined target response. Making this distinction operational is the central purpose of this article.

To document the clinical observations underlying this question, the present article includes a descriptive series of 360 patients whose symptoms persisted after conventional neural therapy. The series records which examination findings occurred together and what short-term changes were documented after a combined treatment plan.

## 2. SCIENTIFIC APPROACH AND APPRAISAL OF THE SOURCES

This article develops the FNT hypothesis from earlier clinical work and a focused narrative synthesis of relevant physiological mechanisms. It incorporates a descriptive analysis of aggregate observations from 360 patients to document how functional findings informed treatment planning. The literature review used a narrative approach, and the clinical analysis reports counts and percentages.

My own publications trace the clinical development of the concept. The early article *Thorakale Wirbelblockaden erfolgreich therapieren* is bibliographically documented for 2008 [25]. The 2010 thoracic review and the article on the autonomic nervous system linked movement dysfunctions with neural therapy concepts [1,2]. In 2014, the commentary on multicausal segmental dysfunction clarified the need to interpret a finding obtained through manual examination as a response with several possible underlying causes [3]. In the same year, the joint publication with von Heymann, Acarkan, and Fischer addressed the combination of manual therapy and neural therapy in sacroiliac dysfunction [4].

The description of the first-rib technique, the two diaphragm publications, and the 2025 thoracic article broadened the anatomical regions considered [6–9]. The manual medicine textbook and the neural therapy atlas place these findings within clinical assessment and treatment frameworks [10,11]. The contribution on ligament infiltration in Weinschenk's handbook, together with the chapters on the thoracic and sacroiliac systems in *Neuraltherapeutic Medicine*, complements this regional perspective [12–14]. A further publication addresses sacroiliac assessment in athletes [15].

These sources serve different purposes. A technical description establishes that a procedure has been described; it does not replace a randomised evaluation of efficacy. A textbook documents a clinical concept but cannot, by itself, establish causality. Nor does the recurrence of similar statements across several of my own publications constitute independent replication. To assess mechanistic plausibility, additional studies on pain-related plasticity, movement adaptation, respiratory and postural control, and the critical interpretation of autonomic measurements are therefore considered [16–23].

Three levels of scientific assertion are distinguished below: established physiological mechanisms, their reasoned application to the regions under investigation, and the FNT hypothesis extending beyond these mechanisms. A plausible application remains an inference. Only studies specific to the anatomical region and patient population can establish whether

that inference holds in a given clinical context. The recent Perspective by Fischer and Schaible [26] is used to develop these predictions.

**2.1 Clinical Series: Patients and Methods**

The descriptive series included 360 patients aged 12–84 years who presented with persistent symptoms after conventional neural therapy at other centres. Of these, 200 (55.6%) were female and 160 (44.4%) were male. Reasons for presentation included fibromyalgia syndrome, migraine, chronic constipation, sleep disturbance, difficulties with insulin regulation, tachycardia, depressive symptoms and low back pain. Counts and outcomes by presenting condition were unavailable.

Initial manual examination assessed the thoracic spinal segments, first rib, diaphragm and sacroiliac joints. The presenting symptoms and examination findings informed the selection of treatment regions. Three to four sessions were planned. Neural therapy was combined with manual mobilisation and, where indicated, post-isometric relaxation. Findings were tabulated as mutually exclusive combinations. Examination and outcome percentages use the full cohort as denominator. The source material provided aggregate data for descriptive analysis.

**2.2 Clinical Series: Results**

Four combinations of manual findings were documented in 330 patients (91.7%). The most frequent was diaphragmatic dysfunction with first-rib restriction. Clinical improvement was maintained through 12 months in all 290 patients who had documented complete resolution of their presenting symptoms by the end of the third treatment session.

The distribution of examination findings in the other 30 patients was unreported (Table 1).

**Table 1: Combinations of findings on manual examination**

| Combination of examination findings | n | % of 360 |
|---|---|---|
| Diaphragmatic dysfunction and first-rib restriction | 105 | 29.2 |
| Thoracic segmental restriction and sacroiliac joint dysfunction | 95 | 26.4 |
| First-rib restriction, thoracic segmental restriction, and diaphragmatic dysfunction | 85 | 23.6 |
| Sacroiliac joint dysfunction, thoracic segmental restriction, and diaphragmatic dysfunction | 45 | 12.5 |
| Total across the four combinations | 330 | 91.7 |
| Combination unreported | 30 | 8.3 |

Complete resolution of presenting symptoms by the end of the third session was documented in 290 patients. A further 45 were reported to improve by approximately 60%. The assessment time and method for estimating improvement in this group were unspecified. Five patients had no clinical response. Eight patients who had travelled from outside Istanbul discontinued treatment after the second session, and outcome information was unreported for 12 patients (Table 2). Patient-level data linking examination findings to outcomes were unavailable.

**Table 2: Short-term clinical outcomes and treatment continuation**

| Outcome or status | n | % of 360 |
|---|---|---|
| Complete symptom resolution by the end of session 3 | 290 | 80.6 |
| Approximately 60% symptom improvement | 45 | 12.5 |
| No clinical response | 5 | 1.4 |
| Discontinued after session 2 | 8 | 2.2 |
| Outcome unreported | 12 | 3.3 |
| Total | 360 | 100 |

## 3. From Classical Interference Field Theory to the Neuromodulatory Trigger

Classical interference field theory describes a persistent source of irritation whose clinical effects may manifest outside its region of origin. Historically, attention focused on scars and tissues previously affected by inflammation or injury, among other potential sources. The distinction from segmental therapy rested largely on the notion of a distant effect extending beyond the usual segmental organisation [5]. A simplified schematic illustration is provided in Figure 1.

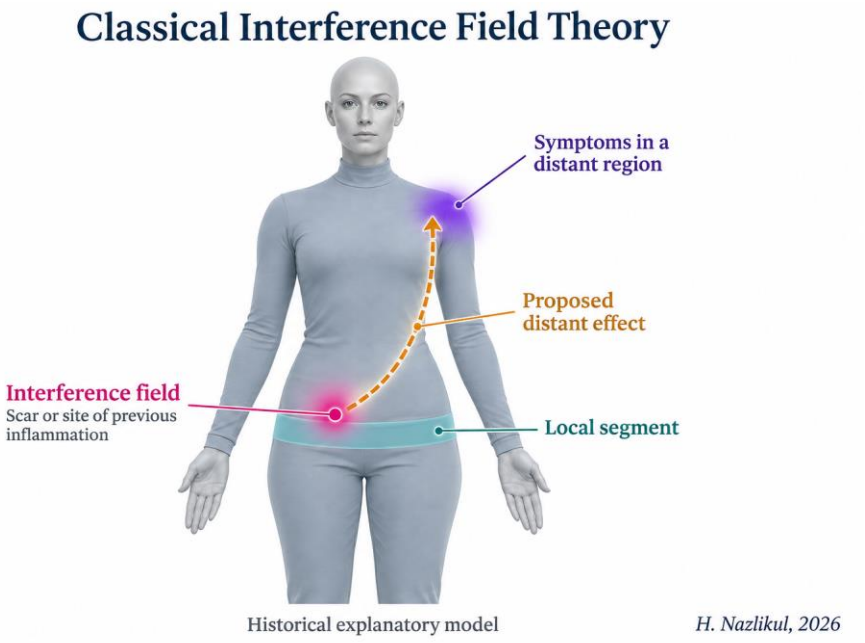



**Figure 1:** Schematic illustration of classical interference field theory. A local source of irritation is linked to symptoms beyond its region of origin. The dashed arrow indicates the hypothesised distant effect.

Engel and colleagues question the equivalence of the anatomical and clinical segment. They discuss intersegmental processing and plastic changes as a basis for redefining the interference field through the concept of the neuromodulatory trigger. This shifts the focus from the distance between the site of origin and the symptom to the neural organisation mediating their relationship. The general term *neuromodulatory trigger* is therefore not newly introduced in this article [5]. A simplified schematic illustration is provided in Figure 2.

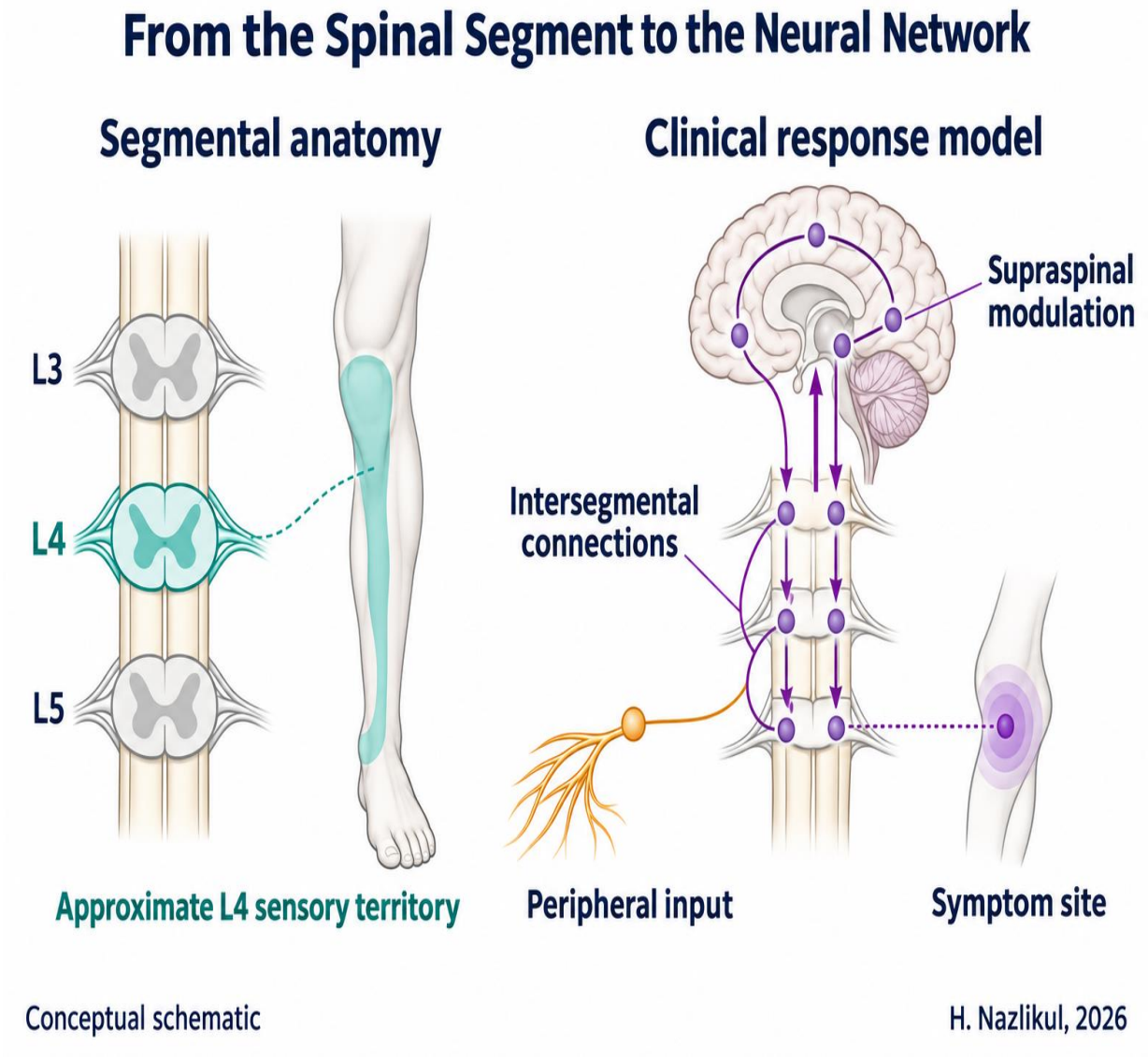



**Figure 2:** From the anatomical segment to the neural network: schematic illustration of intersegmental and supraspinal relationships underlying clinical response patterns.

The extension proposed here concerns the nature of the originating source. Whereas the classical discussion often focuses on previously damaged tissue, the FNT concept addresses a current, potentially reversible impairment of movement or breathing. Any influence it exerts would need to be explained by sustained or recurrent afferent activity, rather than by a necessarily persistent tissue lesion.

This extension remains subject to an important limitation. The neurophysiological plausibility of a distant response does not establish that a particular clinical finding causes it. An explanatory model may demonstrate how an effect could occur. Determining whether it actually occurs, how frequently, and under which conditions requires separate empirical investigation.

The historical term *interference field* must therefore also be interpreted functionally. An anatomical site does not automatically constitute an interference field because of its location or history. In the FNT model, the presumed trigger function represents a relationship between an originating finding and a target response. Without this relationship, a local dysfunction may still be present, but its classification as an FNT is insufficiently supported.

## 4. WHERE DOES A SEGMENT BEGIN AND END?

A spinal segment can be defined anatomically. Its clinical significance, however, extends beyond a sharply demarcated area of skin. Somatic and visceral afferent inputs are integrated within overlapping, interconnected processing systems. A dermatome, a muscle innervation territory, and an area of referred visceral sensation are therefore not anatomically congruent.

For clinical analysis, four levels should be documented separately. First, the presumed primary innervation of the originating structure. Second, possible spinal connections with adjacent or more distant segments. Third, supraspinal processing, including descending modulation. Fourth, autonomic or respiratory responses that may reflect the patient's overall state. Within the FNT model, these levels are treated as distinct domains of investigation rather than equivalent forms of evidence.

An example illustrates this distinction. If a lumbopelvic movement pattern changes following a thoracic intervention, several pathways are conceivable: altered trunk mechanics, a change in respiratory coordination, general pain reduction, or a specific neural mechanism. The observation alone does not identify the predominant pathway. Broadening the concept of the segment therefore requires more precise investigation rather than broader causal attribution.

The spatial extent of a patient's functional response may change over time. At low stimulus intensity, the response may remain local; with prolonged loading or altered pain processing, it may involve additional regions. This leads to the testable proposition that the spatial extent of an FNT-associated response depends on the state of the processing system. This proposition would require repeated measurements within the same individuals.

The term *segment* thus retains its anatomical value. It simply ceases to serve as an absolute boundary for all clinical effects. A differentiated segmental assessment must describe innervation while also examining how incoming signals are processed. Such an assessment cannot be reduced to schematic organ–vertebra associations.

## 5. DEFINITION AND PROVISIONAL DIAGNOSTIC CRITERIA

A functional neuromodulatory trigger according to Nazlikul is a reproducibly demonstrable, potentially reversible dysfunction of a musculoskeletal or respiratory system that, through recurrent or sustained afferent activity, contributes to the maintenance of a defined secondary sensorimotor and, where applicable, autonomic response beyond its immediate region of origin. A simplified schematic illustration is provided in Figure 3.

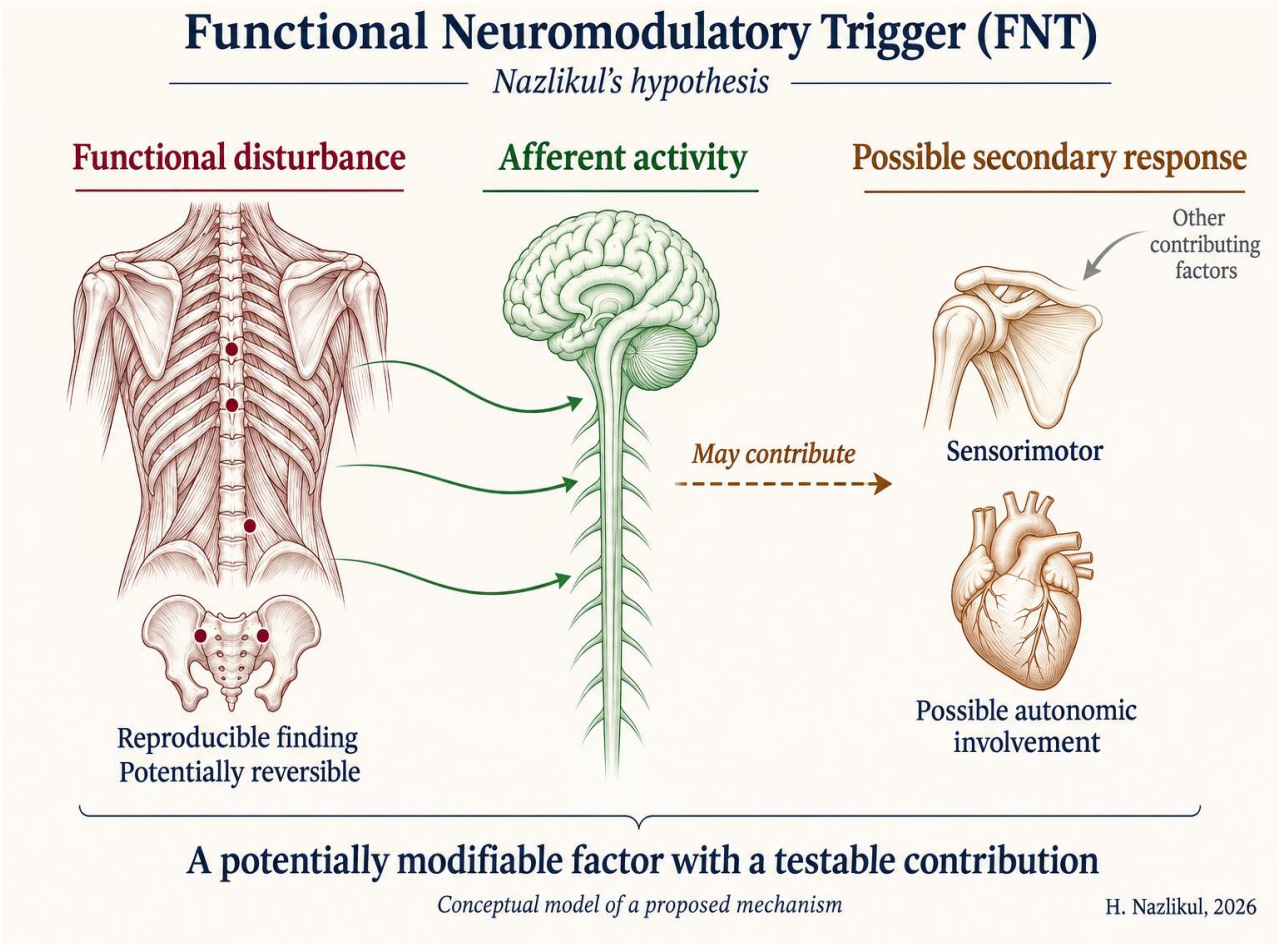



**Figure 3:** Hypothesis model of the functional neuromodulatory trigger according to Nazlikul. Through afferent activity, a potentially reversible dysfunction may contribute to the maintenance of secondary sensorimotor and, where applicable, autonomic responses. The dashed arrow indicates the relationship to be tested.

The definition deliberately uses the term *contributes*. A sole causal role is not assumed. Furthermore, *potentially reversible* refers to the functional component, not to the complete resolution of all symptoms. Structural disease and functional adaptations may coexist. The decisive question is whether a modifiable component with a testable influence can be identified.

A provisional case definition is proposed for research purposes. It is neither a validated diagnostic rule nor a category suitable for immediate use in clinical billing. It would require a repeatedly documented originating finding, a predefined target response, a plausible connection, and a standardised assessment of their modifiability. Treatment response must not serve simultaneously as the basis for the case definition and as independent evidence of efficacy.

Table 3 summarises the proposed criteria.

**Table 3:** Provisional criteria for identifying a candidate FNT

| Criterion | Required documentation | Insufficient evidence |
|---|---|---|
| Originating finding | Reproducible limitation during a standardised task | A single subjective abnormality identified by palpation |
| Target response | A specified symptom or measurable function beyond the region of origin | A general sense of dysregulation |
| Clinical relationship | Temporal or task-related covariation | Mere co-occurrence |
| Modifiability | A predefined reassessment and a controlled intervention | Unstructured improvement following multiple interventions |
| Differential diagnosis | Appropriate evaluation of competing causes | An inference based solely on normal imaging findings |

A candidate FNT may be identified when the originating finding and target response are clearly documented. Classification as mechanistically supported should be reserved for cases in which controlled investigations confirm the relationship. The term *confirmed FNT* should, for now, be withheld until an accepted reference standard and externally replicated diagnostic performance are available.

Normal examination findings do not exclude chronic symptoms. Conversely, the absence of a reproducible target response should limit classification as an FNT. A definition that is considered confirmed by every possible clinical course, including the absence of an effect, would be scientifically untenable.

## 6. AFFERENT PROCESSING AND SENSORIMOTOR FEEDBACK

The model begins with an impairment that recurrently alters sensory input during movement, loading or breathing. Mechanosensory and nociceptive information should be distinguished. Altered movement can occur without tissue threat, while painful loading can occur with little visible restriction.

Spinal and supraspinal systems process these signals in the context of the current task and prior experience. Sensitisation can alter responses to subsequent inputs [16]. In some patients, a local source may help sustain elevated responsiveness while accounting for only part of the pain experience.

Pain also changes the distribution of muscle activity, with considerable variation across individuals [17]. A protective adaptation could impose repeated loads that aggravate local irritation or create a secondary problem elsewhere.

The model therefore proposes reciprocal effects. Altered function changes sensory input, processing changes movement, and changed movement alters loading and subsequent input. Autonomic responses may accompany or reinforce this loop.

Analgesia can leave the loading pattern intact, and improved mobility can leave altered pain processing intact. A combined approach is particularly plausible if both components are demonstrable. Specific synergy requires empirical testing.

Standardised loading tasks provide more interpretable observations than rest assessments alone. A reproducible task-related change should also be investigated as a possible consequence of symptoms.

## 7. AUTONOMIC REGULATION AND PERSISTENT RESPONSE PATTERNS

The autonomic nervous system is central to neural therapy. In the FNT model, local autonomic responses, systemic responses to pain or stress, and specific autonomic mediation between source and target are distinct hypotheses (Fig. 4).

Sympathetic–sensory interactions may perpetuate some pain states [23]. The supporting work largely concerns specific neuropathic or experimental settings. Its relevance to reversible rib or spinal dysfunction remains to be tested.

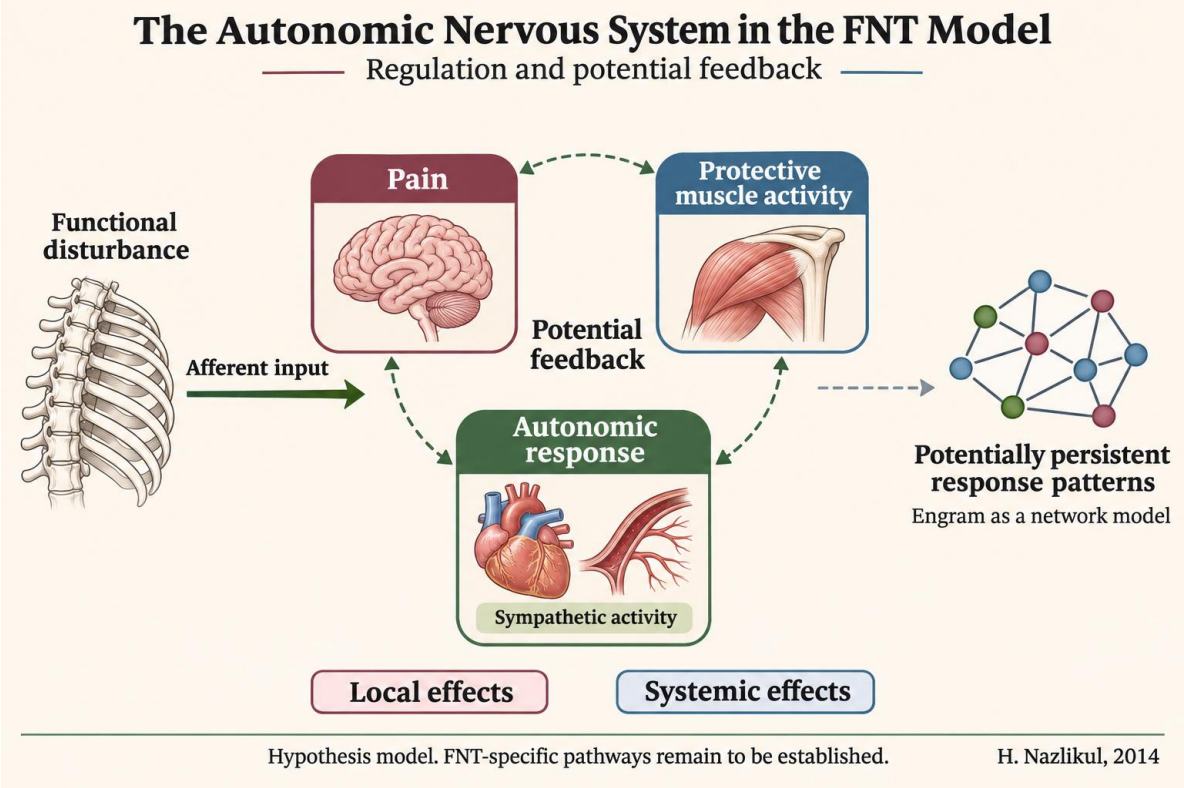



**Figure 4. Autonomic regulation and potential feedback in the functional neuromodulatory trigger (FNT) model.** Afferent input from a functional disturbance may influence pain, protective muscle activity and autonomic responses, including sympathetic activity. The dashed arrows indicate hypothesised feedback among these responses, which may contribute to local or systemic effects and sustain response patterns over time. The term *engram* denotes a proposed network model for this persistence. FNT-specific pathways remain to be established.

A functional impairment could help sustain a response pattern that outlasts its initiating event. Repeated observations are needed to identify the conditions under which the pattern persists or changes.

The proposed sympathetic "engram" is best operationalised as persistence of a response pattern. Altered excitability, reinforcement and repeated exposure to similar loads are possible explanations.

A persistent pattern should be reproducible in defined contexts and should change in a predictable manner when the relevant input is modified under controlled conditions.

Cardiac heart rate variability can complement the assessment. Interpretation requires attention to respiration, posture, medication and measurement conditions. The LF/HF ratio does not reliably quantify sympathovagal balance [22].

## 8. THORACIC SPINE AND COSTOVERTEBRAL COMPLEX

The thoracic region links spinal mobility, rib motion, breathing and postural control. It is therefore a useful setting in which to investigate a defined functional source and secondary response.

The 2010 review described the integration of neural therapy and manual therapy in thoracic dysfunction [1]. The subsequent thoracic work extended the clinical discussion to autonomic regulation [9].

Assessment should distinguish painful restriction from demonstrable structural pathology. The task, direction of restriction and associated symptoms should be documented.

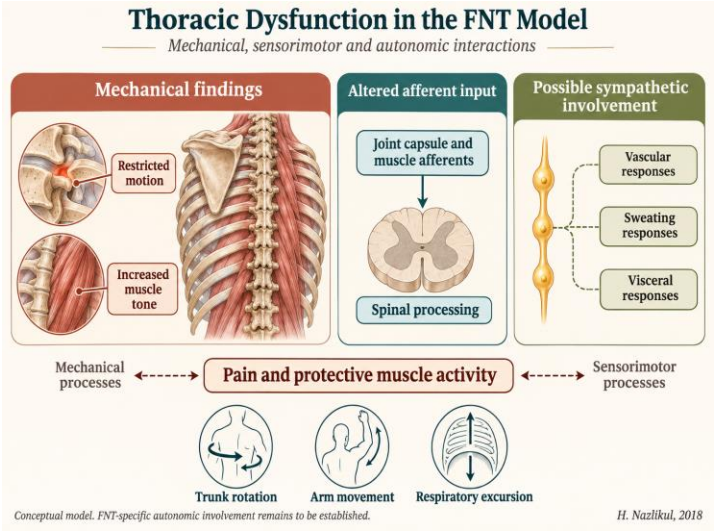



**Figure 5. Thoracic dysfunction in the functional neuromodulatory trigger (FNT) model.** The schematic links restricted thoracic motion and increased muscle tone with altered afferent input from joint capsules and muscles. Dashed arrows indicate possible feedback between pain, protective muscle activity, and mechanical and sensorimotor processes. Trunk rotation, arm movement, and respiratory excursion are shown as functional contexts. Sympathetic involvement specific to the FNT model remains to be established.

A testable example would pair a reproducible restriction in thoracic rotation with a prespecified breathing or trunk-control task and reassess both after a targeted intervention.

Anatomical proximity to sympathetic structures motivates a mechanistic question. Demonstrating

autonomic mediation requires independent physiological evidence.

Differential diagnosis remains essential. Cardiac, pulmonary, neurological and other structural causes of thoracic pain require appropriate evaluation.

## 9. FIRST RIB AND SUPERIOR THORACIC APERTURE

The first rib participates in cervical, shoulder-girdle and upper thoracic function. Its examination and a regional treatment approach have been described previously [6].

A candidate finding would be a reproducible painful or restricted response during a defined cervical, shoulder or respiratory task.

Nearby neurovascular structures are clinically relevant. Anatomical proximity alone provides limited evidence for a mechanism.

Accessory respiratory muscle activity could alter upper thoracic loading and cervical or shoulder movement. Pain-related guarding could also account for the same pattern.

Thoracic outlet syndromes require specific differential assessment. A first-rib examination finding alone is insufficient for the diagnosis.

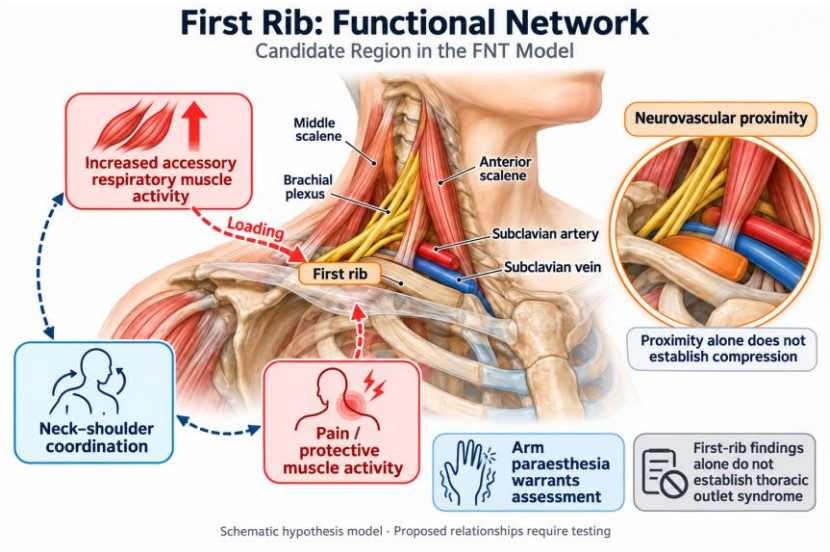



**Figure 6. The first rib as a candidate region in the functional neuromodulatory trigger (FNT) model.** Dashed arrows indicate proposed relationships among accessory respiratory muscle activity, first-rib loading, neck–shoulder coordination, pain, and protective muscle activity. The inset shows the first rib's anatomical relationship to the brachial plexus and subclavian vessels.

The relevant question is whether treatment directed at the first rib adds a reproducible effect on the predefined secondary task beyond local pain relief.

## 10. Diaphragm in Breathing and Postural Control

Experimental work by Hodges and Gandevia demonstrates diaphragmatic activity during postural tasks and its contribution to pressure regulation [18, 19].

Earlier diaphragm publications describe the clinical integration of breathing assessment, manual examination and neural therapy [7, 8].

The phrenic nerve, arising predominantly from C3–C5, provides motor innervation. Clinical coupling with trunk and cervical function may also involve mechanical and central coordination.

A candidate finding might be a task-dependent change in breathing movement and trunk control under a standardised load.

The hypothesis can be tested by measuring a specified respiratory or postural response before and after controlled modification of the candidate impairment.

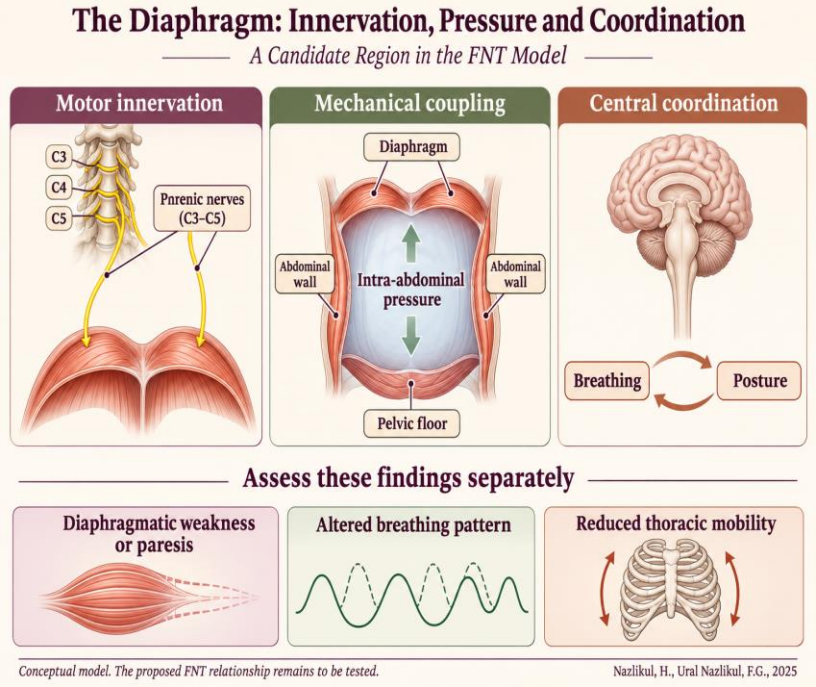



**Figure 7. The diaphragm as a candidate region in the functional neuromodulatory trigger (FNT) model.** The schematic shows phrenic motor innervation (C3–C5), the coordinated roles of the diaphragm, abdominal wall, and pelvic floor in regulating intra-abdominal pressure, and the central coordination of breathing and posture. Diaphragmatic weakness or paresis, an altered breathing pattern, and reduced thoracic mobility are distinct findings and should be assessed separately. The proposed role of the diaphragm in the FNT model remains to be tested.

Dyspnoea, orthopnoea, sleep-related breathing symptoms and marked exercise intolerance warrant appropriate medical evaluation [20].

## 11. SACROILIAC JOINT AND LIGAMENTOUS COMPLEX

The sacroiliac joint combines limited motion with substantial load transfer. Local pain, regional movement and extra-articular contributions can overlap.

The 2014 publication addressed combined manual and neural therapy in the sacroiliac region [4].

The chapter co-authored with Ural Nazlikul describes regional anatomy, biomechanics and clinical examination [14]. Ligament infiltration is described separately [12].

The pelvic ring includes both sacroiliac joints and the pubic symphysis. Lumbar loading, hip motion and muscle control all influence regional function.

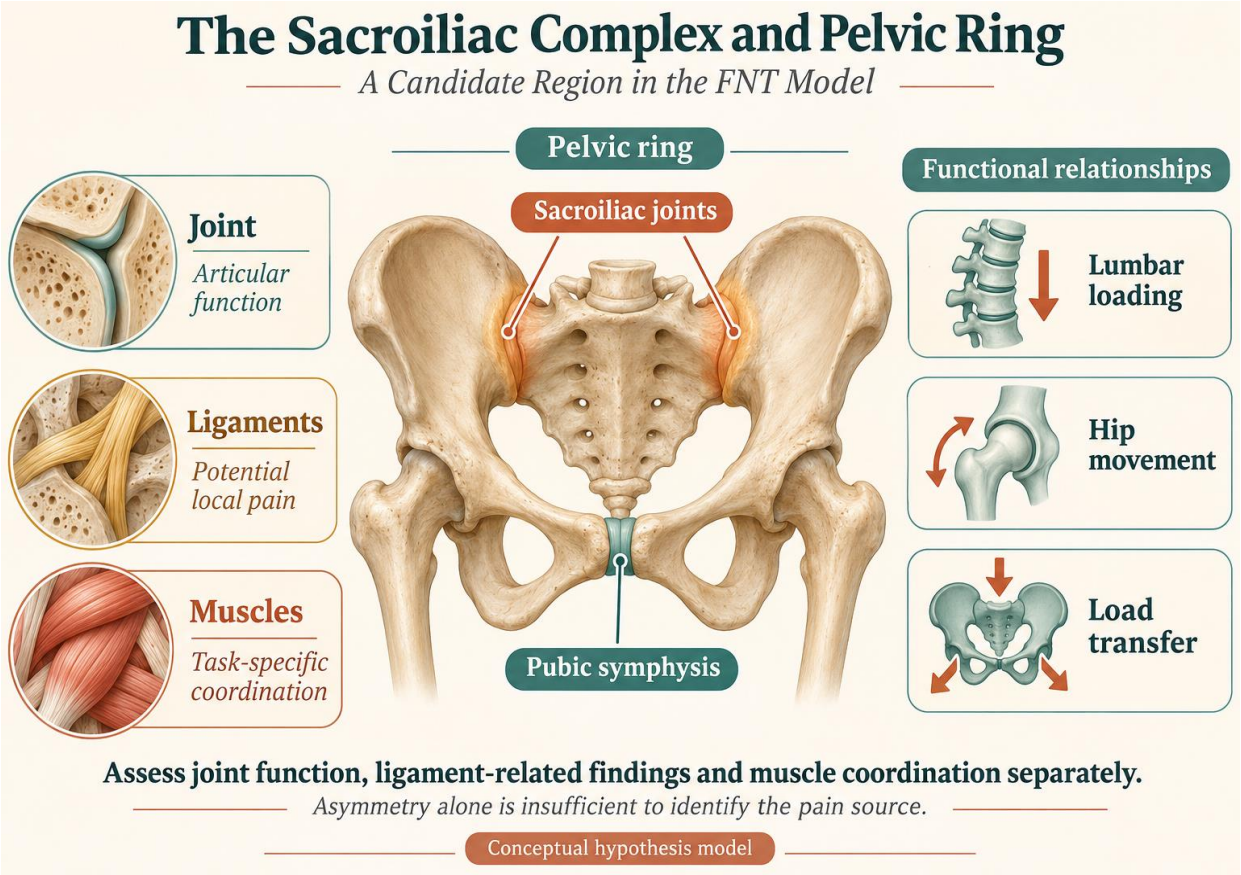



**Figure 8.** The sacroiliac complex in relation to joint, ligament and muscle function during lumbopelvic loading. **The sacroiliac complex and pelvic ring as a candidate region in the functional neuromodulatory trigger (FNT) model.** The schematic highlights the sacroiliac joints and pubic symphysis and illustrates their functional relationships with lumbar loading, hip movement, and load transfer through the pelvis. Joint function, ligament-related findings, and task-

specific muscle coordination are assessed separately. Pelvic asymmetry alone is insufficient to identify the source of pain.

Work on athlete assessment adds a functional perspective [15]. Studies should use prespecified tasks and measures that distinguish loading-related findings from examiner-dependent impressions.

A painful periarticular or ligamentous finding might alter trunk or lower-limb loading. Altered loading might likewise account for the regional finding.

Evidence on sacroiliac pain provocation test clusters illustrates the limited causal specificity of a positive examination [21]. An FNT research definition should integrate independent information and acknowledge uncertainty in the reference standard.

## 12. PUBIC SYMPHYSIS AND PELVIC RING COORDINATION

The pubic symphysis forms the anterior connection of the pelvic ring. In patients with groin or pelvic symptoms, loading and coordination of the adductors, abdominal muscles and hip may warrant examination.

A standardised walking or resisted adduction task can define the target response. Independent examiners should be able to assess both the candidate finding and the target using the same criteria.

Pain during anterior pelvic loading could alter lumbopelvic strategy and redistribute posterior load. The reverse sequence is also possible, making the temporal history relevant.

Gynaecological, urological, inflammatory, neurological and osseous causes require separate consideration. A functional finding may coexist with an underlying disorder, and the FNT question should be confined to its contribution to the defined target.

Links among pelvic floor, trunk and breathing should be studied during specified tasks. The pubic symphysis remains a candidate region with limited FNT-specific evidence.

## 13. FUNCTIONAL RELATIONSHIPS AMONG CANDIDATE REGIONS

The thoracic spine, first rib, diaphragm and pelvic ring participate in shared tasks. Arm elevation changes demands on trunk control, breathing changes pressure, and painful pelvic loading may alter posture and breathing strategy.

An initiating event, a secondary adaptation and a later perpetuating factor may represent different stages of the same clinical course. The current relevance of a finding therefore requires reassessment over time.

Passive mobility and active motor control are distinct outcomes. Studies should assess the function relevant to the patient, alongside any examiner-rated change in mobility.

**Table 4:** summarises candidate regions and corresponding research tasks.

| Region | Candidate function | Possible target response | Principal competing explanation |
|---|---|---|---|
| Thoracic complex | Rotation and breathing-related movement | Breathing coordination or trunk task | General analgesia |
| First rib | Combined cervical, shoulder and breathing task | Shoulder-girdle coordination | Neurological or vascular disorder |

| | | | |
|---|---|---|---|
| Diaphragm | Breathing and postural coordination | Trunk control under load | Primary cardiorespiratory disorder |
| Sacroiliac complex | Lumbopelvic load transfer | Walking or standing function | Lumbar or hip pathology |
| Pubic symphysis | Anterior pelvic loading | Groin symptoms during loading | Underlying pelvic disease |

The table lists candidate relationships for testing. More distant or systemic claims require stronger evidence than an immediately coupled mechanical response.

## 14. CLINICAL ASSESSMENT AND LONGITUDINAL DOCUMENTATION

Begin with the symptom or functional limitation to be explained, the task that evokes it and plausible competing causes. Select the candidate region only after defining that question.

Record baseline pain, function, loading behaviour and relevant comorbidities. Sleep, medication, activity and psychosocial context can influence pain processing and the measurement of responses.

Use a standardised task and an independently assessable retest. Palpation can contribute to the examination alongside reproducible provocation, movement testing or instrumental measurements.

Prespecify the expected response and interval. If local tenderness improves while the defined secondary outcome remains unchanged, the proposed relationship is weakened for that endpoint.

Repeated measurements help distinguish change from spontaneous fluctuation and regression towards the mean, particularly when patients present during a flare.

A minimum record should include the initial task, candidate finding, target response, intervention and retest. Measurement validity determines what can be inferred from the recorded values.

## 15. MANUAL MEDICINE AND NEURAL THERAPY AS DISTINCT INTERVENTIONS

The combined approach informed the clinical development of this hypothesis [1, 4, 10–14]. Manual treatment may change mechanical conditions and sensory input. Local anaesthetic interventions temporarily alter impulse conduction and may have additional biological and contextual effects. Their individual contributions require testing.

Manual therapy models recognise peripheral, spinal, supraspinal and contextual responses [24]. A remote change should be interpreted against the prespecified source–target prediction and a suitable comparison.

A targeted local anaesthetic intervention can help investigate a suspected afferent source. Drug spread, effects on adjacent structures, general analgesia and expectations complicate interpretation. Improvement beyond the anaesthetic period does not identify a specific plastic mechanism.

If both a mechanical limitation and a painful local source can be demonstrated, the two interventions may address different components. A period of reduced pain might facilitate active relearning. The added value of the combination should be tested directly.

Active rehabilitation addresses movement variability, graded loading and, where relevant, breathing coordination. For a model of perpetuating loops, maintenance of function under everyday loading is a clinically meaningful outcome.

Evaluation of invasive procedures requires appropriate qualifications, indications and safety standards. Adverse effects and treatment burden should be recorded systematically alongside benefit.

## 16. SPECIFIC PREDICTIONS AND FALSIFICATION

The hypothesis predicts a reproducible source–target relationship, a larger target response after modification of the source than after a suitable comparison, and greater specific benefit among patients with the prespecified finding.

If the impairment has a perpetuating role, its modification should precede or show a clearly specified temporal relationship to improvement in secondary function. Mediation analysis can inform interpretation within a suitable causal design (Figure 9).

An autonomic mediation hypothesis requires a prespecified physiological response linked to both source and target under standardised conditions. Improvement without the expected autonomic change weakens that pathway hypothesis.

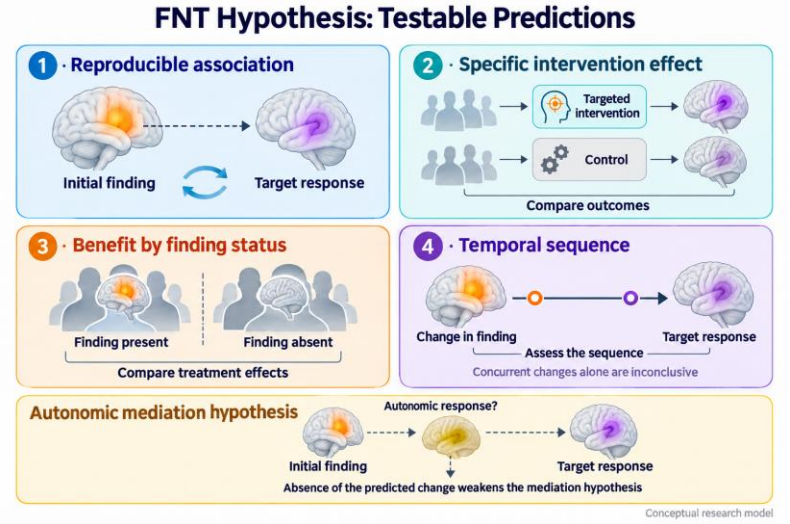



Figure 9. **Testable predictions of the functional neuromodulatory trigger (FNT) hypothesis.** The panels show four criteria for testing the hypothesis: (1) a reproducible association between the initial finding and a predefined target response, (2) a specific effect of a targeted intervention compared with a control, (3) greater treatment benefit in patients with the finding, and (4) a change in the finding that precedes a change in the target response. The lower panel shows the proposed autonomic mediation pathway. Absence of the predicted autonomic change weakens this explanation.

Poor reproducibility or a similar prevalence in asymptomatic controls without prognostic value would weaken the model. Similar effects after interventions at different sites would favour a general treatment effect.

Clinical adoption would require incremental value for prognosis or treatment selection beyond established assessment of pain and function.

Negative findings can identify regions, outcomes and mechanisms for which the proposed trigger relationship should be rejected.

## 17. STAGED RESEARCH PROGRAMME

Phase I should establish operational criteria, interrater and intrarater reliability, measurement error, prevalence in comparison groups and reproducibility across tasks. Diagnostic thresholds should be set independently of subsequent treatment outcomes.

Phase II should examine mechanisms in defined populations. Movement analysis, electromyography and respiratory measures can be aligned to the same task. Quantitative sensory testing may provide complementary data. Autonomic measurements require control of respiration, posture, time of day, medication and loading.

A mechanistic study could compare targeted intervention with a credible regional control matched for contact time and expectation. Assessment should be blinded where feasible, and the credibility of the comparison should be measured.

Phase III could compare manual treatment, neural therapy, their combination and suitable comparison care. A factorial design is appropriate if the primary question concerns component effects and interaction, with sample size planned accordingly.

Use a patient-relevant symptom or functional endpoint as the primary outcome. Include follow-up over several months, systematic recording of co-interventions and harms, analysis by original assignment and prespecified subgroups.

Phase IV should examine independent replication, additional examination time, misclassification and the groups most likely to benefit in routine care.

**Table 5:** summarises the stages and their primary questions.

| Phase | Primary question | Principal outcome |
|---|---|---|
| I. Assessment validation | Is the candidate finding reproducible? | Agreement and measurement error |
| II. Mechanisms | Does the candidate function specifically influence the target response? | Functional change under controlled conditions |
| III. Clinical evaluation | Does FNT-guided selection improve relevant outcomes? | Pain, function and adverse effects |
| IV. Replication and clinical implementation | Is additional benefit sustained in routine care? | Long-term benefit and resource use |

A public protocol, prespecified analyses and transparent reporting should guide each phase. Studies should progress from defined regional relationships to broader systemic predictions.

## 18. CLINICAL RELEVANCE AND HEALTH ECONOMICS

The relationship among underlying disease, functional loss and symptom perpetuation is relevant across primary care, rehabilitation, pain medicine, orthopaedics, neurology and sports medicine.

Clinical value would be demonstrated if an FNT assessment changed an actionable decision, such as selecting an adjunctive intervention, assessing benefit or discontinuing an ineffective treatment.

A functional component may affect symptoms and participation alongside chronic disease. The initial clinical objective is to identify the modifiable functional contribution in a defined presentation.

Additional assessment and treatment carry costs. Economic benefit would depend on meaningful improvements or appropriate reductions in other care. Overdiagnosis, repeated treatment and diagnostic delay are relevant harms.

An economic evaluation should specify perspective and time horizon. It can include treatment, diagnostics, medication, consultations and hospital use, with productivity and quality-adjusted life years where applicable.

Transferability across settings, examiner training and additional assessment time should be considered before wider implementation.

## 19 .DISCUSSION

The functional neuromodulatory trigger (FNT) hypothesis asks whether a reproducible, potentially reversible impairment of movement or breathing can sustain a defined response beyond its region of origin through recurrent or sustained afferent input. Engel et al. [5] provided the conceptual starting point by questioning whether anatomical segment boundaries can distinguish segmental from interference-field effects. The regional studies underlying the present hypothesis [1–4, 6–15, 25] identify places and tasks in which this question can be examined. The proposed extension concerns the source of the input and its demonstrable contribution to a secondary response. A functional impairment that initially develops as an adaptation to pain may later acquire a perpetuating role of its own.

The clinical series illustrates the distinction between a candidate functional finding and a demonstrated trigger. The most frequent documented combination was diaphragmatic dysfunction with first-rib restriction, and thoracic restriction also often accompanied sacroiliac findings. Co-occurrence can guide regional examination, but shared breathing or movement patterns, protective adaptation to pain and a perpetuating effect are all plausible. The pubic symphysis remains a candidate region in the broader hypothesis and was outside the reported assessment of this series.

### 19.1 Relationship to the nonlinear neuroimmune gate model

Fischer and Schaible [26] propose three interacting sites of neuroimmune regulation: peripheral tissues, spinal circuits and supraspinal networks. Their Perspective links the response to a stimulus to the prevailing state of the system. Pre-existing load, or preload, may alter the threshold for a response, and positive feedback may amplify or prolong it. Their discussion places the interference field and the neuromodulatory trigger in relation to preload. The gates are functional constructs, and the equations used to describe them are heuristic. They supply a rationale for testing state dependence in the FNT hypothesis.

Preload and trigger function can be distinguished operationally. Preload describes conditions present before a specified challenge, such as heightened baseline nociceptive sensitivity. Trigger function describes the hypothesised contribution of a particular source of input to a defined response. A longstanding dysfunction could contribute to the background state through sustained input and also produce recurrent input during a particular task. Determining which role is supported requires specifying the observation interval and measuring the baseline state, the candidate source and the target response separately. The term priming should be reserved for a specified biological or physiological process with corresponding

measurements. A manual finding alone cannot establish immune or microglial priming.

### 19.2 Candidate pathways and competing explanations

In the thoracic and respiratory regions, a reproducible impairment during rotation or loaded breathing could change mechanosensory or nociceptive input. Spinal processing could influence the expression of this input in another task, while supraspinal and descending modulation could contribute to variation across contexts or over time. For example, a candidate thoracic finding could be assessed during a standardised rotation task, with a separately defined breathing or trunk-control outcome measured under a fixed load. A change in the target could also arise through direct mechanical coupling, pain-related changes in movement, general analgesia or treatment expectations [16–19, 24]. Persistent symptoms may precede the functional impairment. These explanations generate different predictions about timing, task specificity and the effect of a source-directed intervention.

The neuroimmune interpretation requires an additional evidential step. The gate model addresses inflammatory signalling as well as pain, whereas the primary FNT prediction concerns a defined sensorimotor response. Symptom improvement or increased mobility provides no direct measure of inflammatory activity or gate engagement. An autonomic mediation hypothesis likewise requires a prespecified physiological response that tracks both source modification and the target outcome under controlled conditions. Cardiac heart rate variability may be collected under standardised conditions, with attention to respiration and posture [22]. Its interpretation remains limited to the measured cardiac response. Fischer and Schaible discuss stellate ganglion blockade and vagus nerve stimulation as examples within their model [26]. The applicability of their proposed mechanisms to regional manual or local anaesthetic interventions remains an empirical question.

### 19.3 Biophysical basis of regional coupling and remote responses

The first rib, diaphragm, thoracic spine and sacroiliac joint (SIJ) participate in shared functions during breathing, postural adjustment and load transfer. The biophysical question is whether a local change in stiffness, excursion, pressure generation or muscle recruitment alters a measurable response elsewhere during a defined task. Anatomical distance alone has limited explanatory value. Mechanical forces can be redistributed across the trunk, and sensory information can be integrated across spinal segments and supraspinal networks [5, 16–19, 27, 28].

**First rib and thoracic spine.** The scalenes contribute to inspiratory expansion of the upper rib cage, and the costovertebral articulations couple rib excursion to thoracic motion [6, 13, 27]. During a task combining arm elevation and inspiration, a painful or restricted upper thoracic segment could change the relative movement of the neck, ribs and shoulder girdle. Conversely, increased inspiratory recruitment or protective muscle activity could produce the observed rib restriction. A manual finding at the first rib therefore has several plausible mechanical explanations. Establishing a functional relationship would require showing how the finding varies with respiratory demand, thoracic position and the task used to elicit the secondary response.

**Diaphragm and lumbopelvic load transfer.** The diaphragm contributes to ventilation and is recruited during postural tasks. Changes in its activity, coordinated with the abdominal wall, can alter intra-abdominal pressure [18, 19]. The SIJ transmits load between the trunk and lower limbs, with joint geometry, ligaments and muscle forces contributing to its mechanical behaviour [28]. Under an asymmetric load, a change in breathing or trunk recruitment could alter how forces are distributed through the pelvis. Pelvic pain could likewise change trunk bracing and breathing strategy [17]. This gives a plausible route for bidirectional functional coupling. The cohort contains no pressure, motion or load measurements with which to establish a direct causal relationship between diaphragm function and SIJ findings.

**From regional input to a remote response.** Two pathways could operate together. Through mechanical redistribution, guarding at one site could alter motion or loading at another. Through neural processing, recurrent afferent input from a painful or mechanically challenged region could influence segmental and intersegmental circuits, while descending modulation could alter how that input is expressed [5, 16, 17, 24]. In a sensitised state, an otherwise modest input could contribute to a response outside its region of origin. The neuroimmune gate model adds the prediction that this response depends on the starting state and may be sustained by feedback [26]. A local finding could thus contribute to a complex symptom pattern alongside other influences. The mechanism and its clinical relevance must be established separately for each proposed source–response pair. Anatomical proximity and symptom improvement after a regional intervention offer limited evidence for a specific neural or autonomic pathway.

A testable example would pair a reproducible first-rib or thoracic finding with a predefined breathing or lumbopelvic task. Regional excursion, trunk or shoulder-girdle muscle activity and the remote functional response could be measured during controlled breathing and standardised loading. Repeated assessments and a credible comparison intervention could establish whether modification of the regional finding precedes a change in the remote response. An independent measure of baseline nociceptive sensitivity would allow the prespecified test of state dependence. In the 360-patient series, the co-occurrence of diaphragmatic and first-rib findings and of thoracic and SIJ findings identifies clinically relevant combinations for such studies. Without patient-level links between findings and outcomes or direct physiological measurements, their biomechanical and neural contributions remain unresolved.

### 19.4 Interpretation and Limitations of the Clinical Case Series

By the end of the third treatment session, the symptoms that had prompted consultation had completely resolved in 290 of 360 patients (80.6%). Follow-up assessments at 3, 6 and 12 months showed that this improvement was sustained in all 290 patients. **No recurrence of the presenting symptoms was documented in this group during the 12-month follow-up.**

Twenty of the 290 patients reported other health problems during follow-up. Of these, 14 developed COVID-19 and reported fatigue around the time of infection. The original presenting symptoms remained

resolved in all 20 patients. The follow-up outcome therefore refers specifically to the symptoms for which treatment was sought.

The absence of a comparison group limits causal interpretation. The natural course of symptoms, regression to the mean, delayed effects of previous treatment and contextual effects may have contributed to the observed outcomes. Neural therapy, mobilisation and, where indicated, post-isometric relaxation were delivered as part of a combined treatment plan, so the contribution of each component could not be estimated. The cohort was clinically heterogeneous, and the available data did not allow outcomes to be analysed by presenting complaint or examination pattern. For patients with partial improvement, the timing and method of assessment were unspecified. Eight patients discontinued treatment after the second session, and outcomes were unreported for 12. Adverse events were not systematically recorded.

For the functional neuromodulatory trigger (FNT) hypothesis, the sustained resolution of the presenting symptoms provides a basis for testing whether a reproducible change in a suspected functional impairment precedes and contributes to lasting improvement in a predefined secondary outcome. Prospective controlled studies should assess the candidate impairment and the secondary outcome independently at prespecified intervals and document symptom recurrence, new health problems and additional treatments. Whether autonomic or inflammatory processes contributed to the observed course remains undetermined.

**19.5 Predictions, Falsification and Clinical Value**

The gate model adds a specific prediction to those in Section 16. The relationship between the candidate impairment and the secondary response should vary with a prespecified measure of the patient's baseline state. For a thoracic pain study, baseline nociceptive sensitivity could be measured independently of the manual finding and tested as a continuous effect modifier. The outcome would be a prespecified change in the secondary response during a standardised task. Repeat baseline measures would help quantify within-person variation, and blinded outcome assessment would reduce observer bias. Exploratory interactions would require replication in an independent sample.

A subsequent controlled study could compare an intervention directed at the candidate source with a credible comparison matched for contact and expectation. The candidate finding and the secondary response should be assessed separately and at intervals that allow their temporal relationship to be examined. Evidence for a specific perpetuating role would strengthen if the finding were reproducible, the targeted intervention modified it, and a subsequent change in the target exceeded that observed under the comparison condition. An unchanged target despite reliable modification of the source would weaken the proposed relationship for that outcome. Similar target responses across intervention sites would favour a more general treatment effect. A state-dependent association would still require further evidence to establish mediation, and a statistical interaction alone would not demonstrate nonlinear dynamics.

The clinical justification for FNT hinges on whether it improves prognosis or treatment selection beyond established assessments of pain and function. My earlier regional publications and the present narrative

synthesis provide the basis for the hypothesis. The clinical series identifies examination patterns and treatment decisions that can inform its prospective evaluation. Independent replication, reliable case identification and prospective testing are needed to establish its clinical value. At the bedside, the question remains the one that prompted this work: what measurable and modifiable contribution does this particular impairment make to this patient's symptoms now?

### 19.6 Synthesis of the Functional Neuromodulatory Trigger Concept

The functional neuromodulatory trigger (FNT) model extends the classical interference field concept by asking whether a reproducible impairment of movement or breathing can help sustain symptoms beyond its region of origin. Altered loading at the first rib, thoracic spine, diaphragm, sacroiliac complex or pelvic floor may generate recurrent or sustained afferent input. Whether that input contributes to a remote sensorimotor or autonomic response may depend on the patient's baseline state. **Figure 10** summarises this proposed pathway and the corresponding clinical test: whether a targeted intervention produces a greater change in a prespecified secondary outcome than an appropriate comparator.

Figure 10 brings together the origins of the functional neuromodulatory trigger (FNT) concept, its proposed mechanisms and the clinical steps needed to test it.

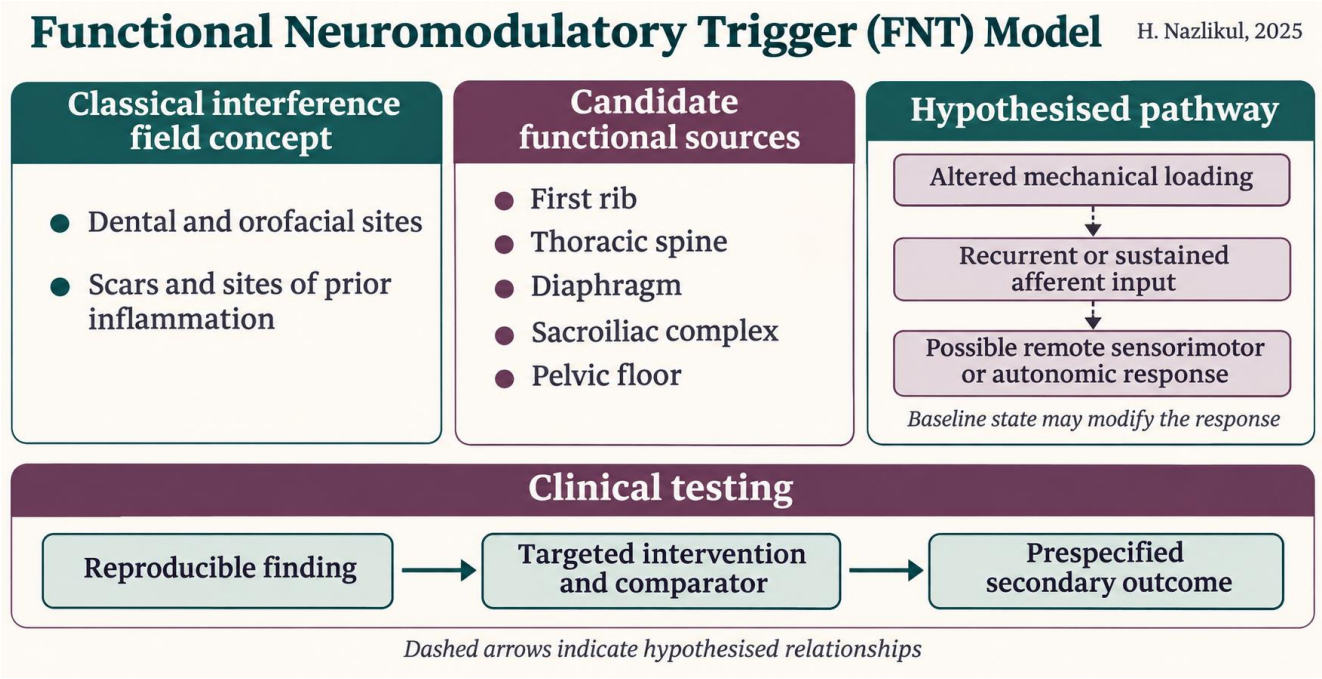



**Figure 10. Functional neuromodulatory trigger (FNT) model and its clinical evaluation.**

The schematic links the classical interference field concept to candidate functional sources and illustrates how altered mechanical loading might contribute to recurrent or sustained afferent input and a remote sensorimotor or autonomic response. Dashed arrows indicate hypothesised relationships. The lower panel outlines how to test these relationships using a reproducible clinical finding, a targeted intervention

with an appropriate comparator, and a prespecified secondary outcome. Adapted from H. Nazlikul (2025).

## 20. CONCLUSİON

The functional neuromodulatory trigger (FNT) hypothesis extends interference field theory by proposing that a reproducible, potentially reversible mechanical or respiratory impairment may help sustain a defined secondary response beyond its region of origin through recurrent or sustained afferent input. Candidate regions include the thoracic spine, first rib, diaphragm, sacroiliac complex and pubic symphysis. The proposed mechanisms and the clinical relevance of each finding should be evaluated separately for each region. The neuroimmune gate model proposed by Fischer and Schaible [26] adds a testable prediction: the relationship between the initial finding and the secondary response may vary with the patient's baseline state.

In the case series of 360 patients, co-occurring functional findings informed the planning of combined treatment. In 290 patients (80.6%), the presenting symptoms had completely resolved by the end of the third treatment session. No recurrence of those symptoms was documented in any of these 290 patients during the 12-month follow-up. These observations warrant investigation in other centres under controlled conditions. The uncontrolled design precluded estimation of the individual contributions of neural therapy, mobilisation and post-isometric relaxation. Whether a targeted change in a specific functional finding contributed to the sustained outcome also remains uncertain.

We recommend prospective multicentre observational studies followed by randomised controlled trials, with prespecified protocols and prior approval from the relevant research ethics committees. Multicentre studies should first establish whether different examiners can reproduce the findings and whether those findings predict subsequent outcomes. Controlled trials should then test whether FNT-guided treatment provides a clinically meaningful benefit over an appropriate comparator. Double-blind designs should be used where feasible, with explicit reporting of who was blinded. For manual interventions, outcomes should be assessed by independent, blinded evaluators. The suspected functional impairment and the prespecified secondary outcome should be assessed independently, with systematic documentation of symptom recurrence, additional treatment and adverse events.

Given rising healthcare expenditure, these studies should include an economic evaluation from the outset. If a reproducible FNT assessment improves treatment selection, it could reduce repeat consultations and the use of diagnostic tests or treatments that offer little benefit. Whether this translates into meaningful cost savings will depend on the resources required for assessment, clinician training and treatment. Economic evaluations should therefore measure healthcare resource use alongside outcomes that matter to patients, including functional ability, symptom burden and quality of life.

The clinical value of the FNT concept will depend on whether a reproducible finding improves treatment decisions and whether those decisions lead to lasting benefits for patients. The present case series provides a basis for pursuing these questions in independent, methodologically rigorous studies.

**Author Contributions**

Hüseyin Nazlikul and Fatma Gülçin Ural Nazlikul contributed to a comparable extent to the scientific development and completion of the manuscript.

The original conception and development of the functional neuromodulatory trigger (FNT) hypothesis originated with Hüseyin Nazlikul. He formulated the central concept of investigating functional disturbances in relation to segmental afferent input, neuromodulatory irritation, and potential secondary regulatory responses within a clinically testable working hypothesis.

Fatma Gülçin Ural Nazlikul made substantial contributions to the scientific development and refinement of the hypothesis, literature research, critical evaluation of the underlying neurophysiological concepts, and preparation and revision of the manuscript.

The authors' joint clinical and scientific investigations concerning the first rib, diaphragm, and sacroiliac joint provided an important foundation for the development of the present concept.

Both authors critically reviewed and approved the final version of the manuscript and accept responsibility for its scientific content.

**Informed Consent**

Not applicable.

**Data Availability Statement**

Not applicable.

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We also remember with profound gratitude our colleague and mentor, Dr. Wolfgang von Heymann, who passed away in 2019.

His dedication to manual medicine, his nuanced understanding of functional disturbances, and his support for the further development of manual medicine concepts influenced our clinical thinking over many years.

His scientific contributions and personal influence continue to inspire our ongoing exploration of functional interference fields.

We are indebted to all three colleagues for their valuable intellectual contributions, which have helped shape our current scientific perspective.

This hypothesis model also reflects our commitment to translating these clinical experiences and scientific insights into a neurophysiologically grounded, empirically testable research question.

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