2009 Fascia Research Congress and Scientific Background

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The conference will take place at the Institute for fundamental and clinical human movement sciences (IFKB), which is in the Faculty of Human Movement Sciences of Vrije Universiteit (VU) in Amsterdam. This institute has 200 faculty members and has as its mission: The development of a theoretical framework, based on empirical research, for understanding the execution, control and constraints of normal human movement; The development of an understanding of disordered human movement as a result of various diseases, trauma and age-related impairments; The integration of knowledge about human movement from different disciplines, both basic and applied, especially in the understanding of adaptation, aging and fatigue; The application of the understanding of human movement to specific problem areas, populations (e.g., the elderly) and activities, as encountered in orthopaedics, rehabilitation, ergonomics and sports. Both the location in a school of human movement science and the conference format will encourage development of both basic and clinical research with relevance to clinical practice.

Fascia research is a newly defining field. Fascia 2009 will complement fascia 2007 to cover the broad spectrum of scientists and disciplines represented. This conference differs from the First Congress in several important ways:

1) Sections on surgical implications of fascia and on evidence basis for clinical practice of manual therapies will be added

2) The congress will be located within the Human Movement Sciences Faculty at Vrije Universiteit in Amsterdam, an international academic leader

3) The conference is extended from 2 days to 4 days to allow more time for questions and interactions.

4) Tours of research laboratories at VU will be added for attendees interested in gaining exposure to research and to specific research techniques applicable to manual therapies.

5) The focus of the second conference is presentation of findings from leading scientists who were not keynote speakers at 2007.

6) Abstracts are requested in several areas:

A. Basic Science: Anatomy of Fascia, Biomechanics of Fascia, Cytology / Histology of Fascia, Modeling and Fascia, and Pathology and Fascia

B. Clinical and Preclinical Science: Manual Therapy and Fascia, Muscle-fascia statics and Dynamics, Fascia in Surgery and recovery from Surgery, Low Back Pain and Lumbar Fascia, and Fascia related research on special populations (e.g. women, persons with disabilities)

C. Research Methodologies and Measurement of Fascial Change

D. Case studies or clinical findings suggesting clinical mechanisms or directions for basic research

E. New Hypotheses

Scientific Background

The past few years has seen an increasing development of scientific findings in several key areas: In back pain research, the flexion relaxation phenomenon has led to the study of creep of lumbar fascia in extended periods of forward bending and to an understanding of the lack of support of passive structures in segmental instability as source of low back pain or peri partum pelvic pain; Fascial contractures as in palmar fibromatosis (Tomasek 1999), plantar fibromatosis, or in the frequent capsular contracture of a frozen shoulder; Involvement of feedback from fascial mechanoreceptors for motor control. I.e. mechanoreceptors from knee ligaments and capsule alter motor tone (Solomonow 2004).

Food scientists have been interested in **connective tissue structure** within muscle for food quality purposes. However, Purslow's review of connective tissue within muscle (2002) is little known in medical research, being referenced only a few times. He finds that Intramuscular connective tissue (IMCT) is structured to provide a constant trans laminar shear stiffness across physiological ranges of muscle length, thus providing considerable load sharing between adjacent fibers. This effect is particularly evident during contractions less than maximal, which may explain why it has escaped the notice of many exercise physiologists. Purslow (1998) has also shown that in the perimysial connective tissue separating muscle fascicles, the fibers have a crossed ply arrangement oriented to the muscle fiber direction and as the tissue is extended these fibers become more aligned with the direction of stretch. When stretch is maintained at a fixed excursion distance, these tissues show stress-relaxation. When constant load is applied, tissues show continued creep. Both of these situations do not involve further straightening or de-crimping of the fibers, and Purslow suggests changes within the fibers themselves or and the interface between the fibers and the matrix surrounding the fibers is more likely as a cause of these findings than changes to the matrix itself. These changes are seen over a 10 to 30 second period, well within the range achievable during manual therapies. Fibrillin rich Micro fibrils are structural elements of all dynamic connective tissues. Their structure and function has been conserved evolutionarily and provide long-range extensibility and flexibility. These micro fibrils have the capacity to change the orientation of elastin fibers and thus contribute to directing load bearing. Studies are now showing the effect of micro fibril turnover in ageing on the loss of connective tissue elasticity (Sherratt, 2001).

There is just the beginning of research on **fascia in special populations**. Dr. Huijing has looked at extramuscular fascial connections between forearm muscles in persons with spasticity undergoing tendon transfer (e.g. Smeulders 2005). Intraoperative studies of spastic forearm muscles in persons with cerebral palsy demonstrate myofascial pathways to be strong enough to transmit force between muscles adjacent to the disconnected distal tendon of the flexor carpi ulnaris (FCU). Analysis of active and passive force –length relationship of the FCU in 14 persons with CP undergoing tendon transfer showed high active and low passive force at maximal wrist extension, implying that sarcomere overstretching at wrist extension is not occurring (Smeulders Kreulen 2004). Even when FCU length is fixed, the FCU active force may vary by 40% depending on the adjacent structure length, with considerable variability from patient to patient . Surgical consideration of the myofascial pathways may reduce the variability in surgical outcome from current surgical procedures. (Smeulders Kreulen 2007)

Clinicians point to the **importance of the fascial network of the body to muscle activity.** Persons with spastic paresis develop limited joint range of motion; when conservative measures fail they can be treated surgically by aponeurotomy which restores function but has a high recurrence rate. Yucesoy (2007a, 2007b) shows through finite element modeling that after aponeurotomy the effects on muscle is far from uniform: in the muscle after surgery, proximal sarcomeres may lengthen by 70% while distal sarcomeres shorten by 20%; this is due to intra and extra-muscular myofascial force transmission which remain intact after surgical modification of myotendinous force transmission.

NIH supported research by Langevin showed that acupuncture needling results in direct mechanical stimulation of connective tissue fibroblasts, and that acupuncture needle insertion and rotation transmit mechanical force through adjacent fascia for some distance (Langevin 2006). Her work also shows that cell morphology in fascia alters markedly with modest static stretch of the fascia (Langevin 2005). In addition work from this laboratory also suggests that fascia may provide a body wide communication network (Langevin 2006, 2004). More data on signaling in fascia sheets comes from research of German investigator Robert Schliep, who found that fascia is not just a passive tissue, that it can actively contract and relax in a smooth muscle like manner and thereby influence musculoskeletal dynamics (Schleip 2003a, 2003b, 2005, 2006). Fascial tonus regulation has been shown to be influenced by two main factors: mechanostimulation and chemical transmitters, such as TGF-beta1, oxytocin, or nitric oxide.

Contribution of connective tissues toward efficient movement: A noninvasive ultrasound method has been developed to measure absolute muscle fiber length and rate of change during muscle contraction in humans in vivo (Kawakami 2006). An efficient method of power production used frequently in locomotion is achieved through Elastic properties of the connective tissues in the muscle-tendon unit which provide additional power. In vertical jumping, which involves shortening of muscle preceded by active lengthening; Fascicles shorten by 30% with tendon elongation of 6% (Kawakami 2002) (Fukunaga 2002).

Manual therapists often point to **head posture as a key element in overall body function**. Nichols has shown the importance of neck and head position in the control of limb movement. In decerebrate cats walking on level surfaces, changes in head pitch (down or up) resulted in immediate change in muscle activity which was similar to those changes which would be seen with uphill or down hill walking respectively (Gottschall 2007). Similarly, manual therapists refer to "**muscle memory**" which is as yet poorly defined. This concept, at least in the very short term time frame, is shown by prior movement affects on both the initial and the dynamic response of muscle spindles and stretch receptors (Nichols 2004)

Clinicians report a **sensation of tissue release during myofascial therapies**. For dense fascia such as tensor fascia lata and plantar fascia, the pressure and shear forces typically provided by the clinician during manual therapies are shown by mathematical modeling to be insufficient to stretch these tissues; in contrast pressures on the nasal fascia during therapies are well within the range which can have physiological effect (Chaudhry 2008).

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