# *PainMonitor*™

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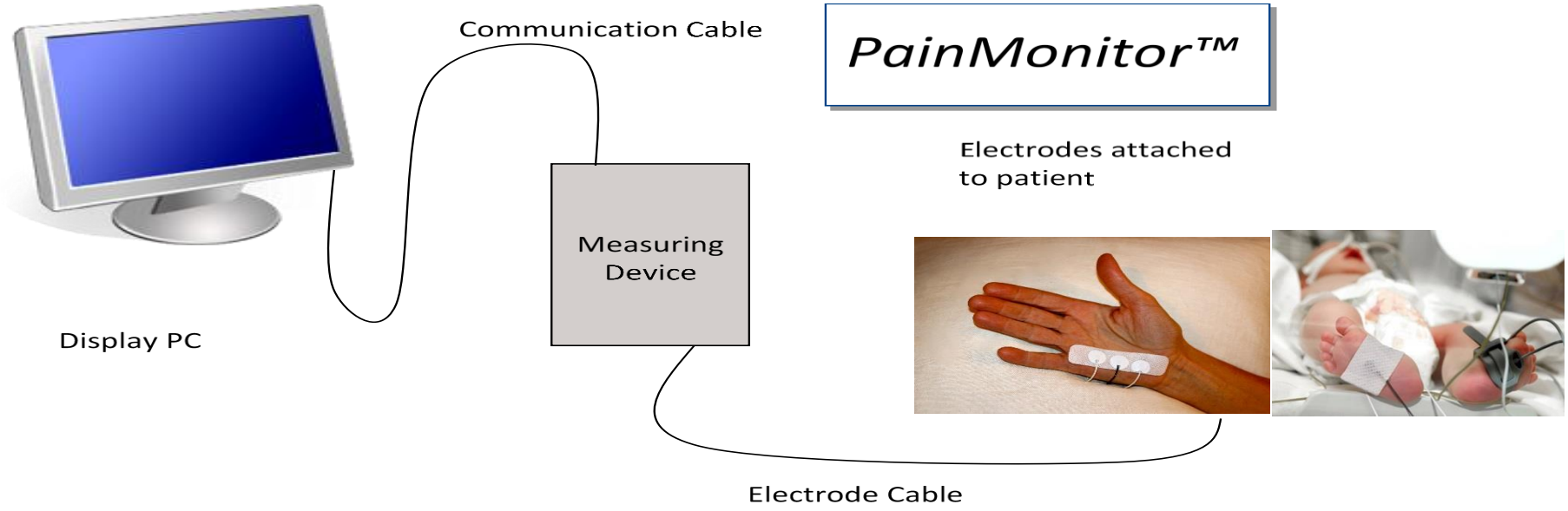
**The Only "Objective" System Available for Detecting and Monitoring Pain Using Real-time Measurements During Anaesthesia, in the Post-operative setting and The Intensive Care setting for adults, children, infants and preterm born infants**



# *PainMonitor*™ - Important Opportunity

**MED-STORM Innovations (Oslo, Norway) [MSI] is a private company focusing on analyzing skin conductance, or emotional sweating, in order to monitor and detect stress/pain and awakening in patients in an OR setting, in Intensive Care units (adult and children), in Postoperative units, and in Neonatal units.**

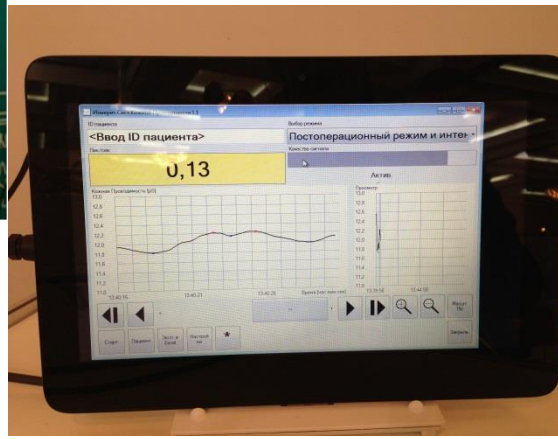
- MSI has proprietary electrodes for the Skin Conductance Algesimeter, *PainMonitor*™.
- *PainMonitor*™ addresses the unmet need for consistent and quantifiable pain assessment and treatment, and its use is mandated by the recommendations of the Joint Commission on Accreditation of Healthcare Organizations in the US (JCAHO) and of similar bodies in Europe.
- *PainMonitor*™ is protected by 6 granted patents and 14 pending patents.
- There is substantial supporting scientific documentation (250 publications) in anesthesia, intensive care, postoperative care, and pre-term infants: 3,200 patients have been monitored over 11 years, across Europe, USA and Australia.
- *PainMonitor*™ is CE-marked since December 2007, an FDA application (510k) has been filed with ongoing pivotal study, and CMS reimbursement coding identified.

# *PainMonitor*™ - Product Description

***PAINMONITOR*™ is the only system available that uses real-time data measurements to handle pain/surgical stress and awakening during anesthesia, as well as in intensive care, in adults, children and infants.**

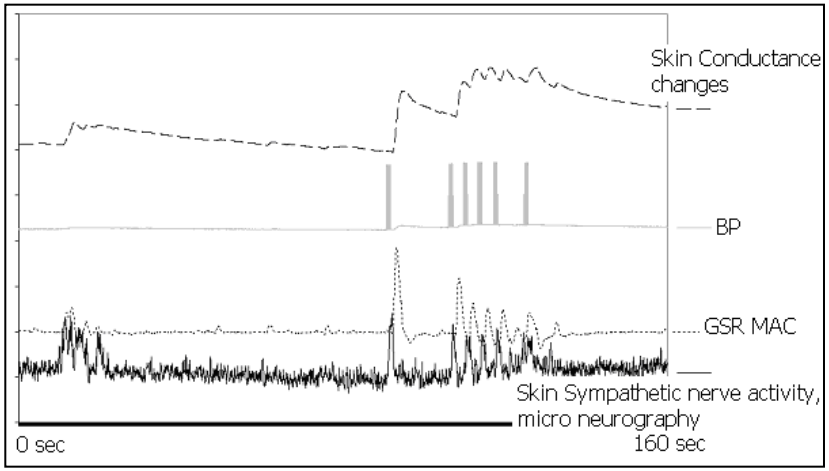
- *PAINMONITOR*™ consists of a measuring unit, small self-adhesive electrodes, and a combined computer/data monitor used for display and analysis.
- The data is subjected to real-time analysis, and fluctuations in the data graph are quantified and displayed in numeric readout form.
- Standard Indices are currently being developed for anesthesia, intensive care, postoperative care, and pre-term infants.
- Studies to predict patients who develop chronic postoperative pain are ongoing.
- The software may be installe at the Philips monitors, the Mindray montors or PCs.

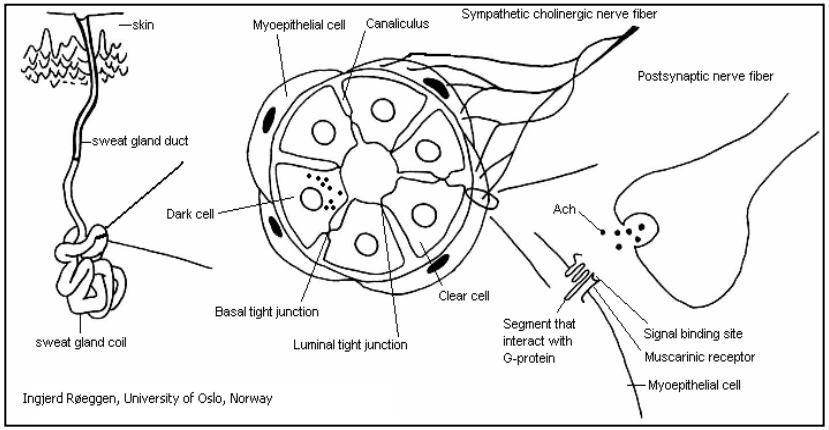




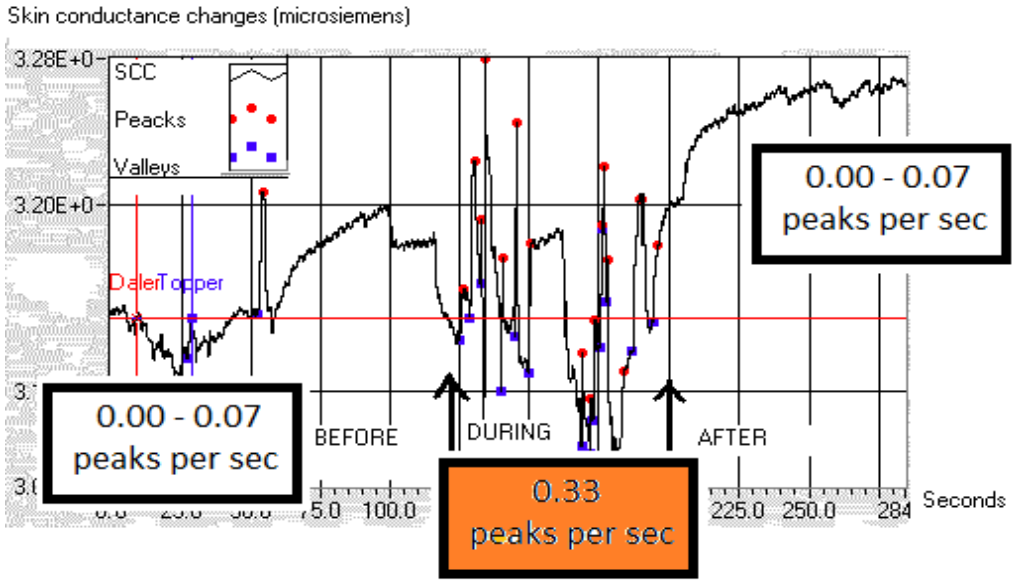
# *PainMonitor*™ - Product Description

- The Skin Conductance Algesimeter index, peaks per second, directly mirrors the number of bursts in the sympathetic nerves in the skin, and reacts in real time within 1-2 seconds.
- The index shows emotional or palmar/plantar sweating (different from temperature dependent sweating). Acetylcholine acts on muscarinic receptors. The method is therefore not influenced by neuromuscular blockers, hypoxia , environmental temperature, respiratory rate, or medication acting on blood circulation (such as beta-blockers and epinephrine) **different from the GE's surgical stress index and ANI from Metodoloris.**
- When patients are at the same pain/discomfort level, there is very low variation between and within individuals **different from the GE's surgical stress index and ANI from Metodoloris.** It is therefore possible to develop an index that is valid for all patients for the Skin Conductance Algesimeter index.
- High scientific validation: ”pain” and ”skin conductance” gives more than 250 hits in Pub med. These studies show, among other things, that the Skin Conductance Algesimeter index increases during painful procedures at the same time as areas in the brain for pain perception are activated.



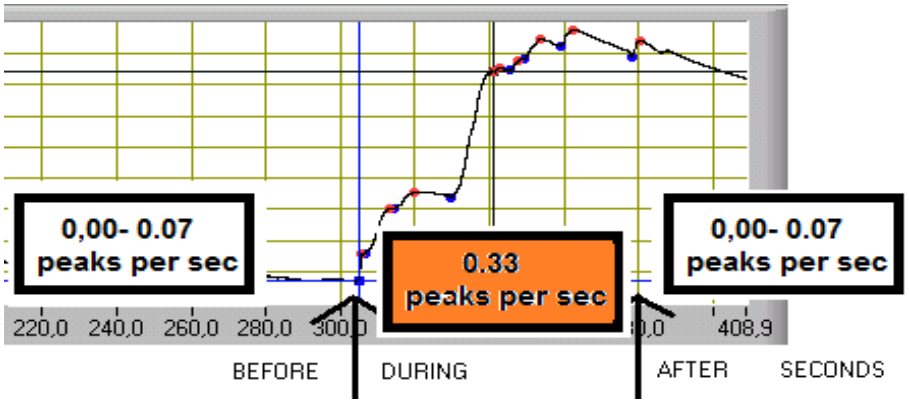
# *PainMonitor*™ - Clinical Validation




| | |
|---|---|
| **WHITE: 0.00-0.07 peaks per sec** | **The infant is calm (15 infants studied 6 times asleep, peaks per sec: median: 0.00 range 0.00-0.04).** |
| **LIGHT YELLOW: 0.14 peaks per sec** | **The infant is calm and moves a little** |
| **YELLOW: 0.21-0.027 peaks per sec** | **The infant is active, the infant pain/discomfort threshold is reached [observe the infant]** |
| **ORANGE: 0.33 peaks per sec** | **The infant is probably in pain/discomfort [evaluate the situation]** |
| **RED: 0.40 peaks per sec or more** | **The infant is in increasing pain/discomfort** |

- **This graph and commentary shows the Skin Conductance Algesimeter index for infants**, based on NIDCAP nurses behavioral rating observation and pain scores.
- The registration curve is before, during and after heel stick for blood sampling.
- The index (peaks per second) increases during painful procedures from gestation age 24-25 weeks, and is not influenced by gestational and postnatal age because it is based on skin sympathetic nervous system which is developed to its final stage at 23 weeks gestational age. In total, 500 preterm infants have been examined before during and after painful procedures. All the studies performed show that the index increases during these procedures, and that the index is not influenced from age.
- **The GE's surgical stress index is not developed for infants. GE has no equipment to monitor pain in infants. ANI from Metodoloris is based on changes in the parasympathetic nervous system influencing the respiratory rhythm which then influences heart rate variability. The parasympathetic nervous system continues to develop after 1 year of age. The ANI index is therefore highly influenced from age.**

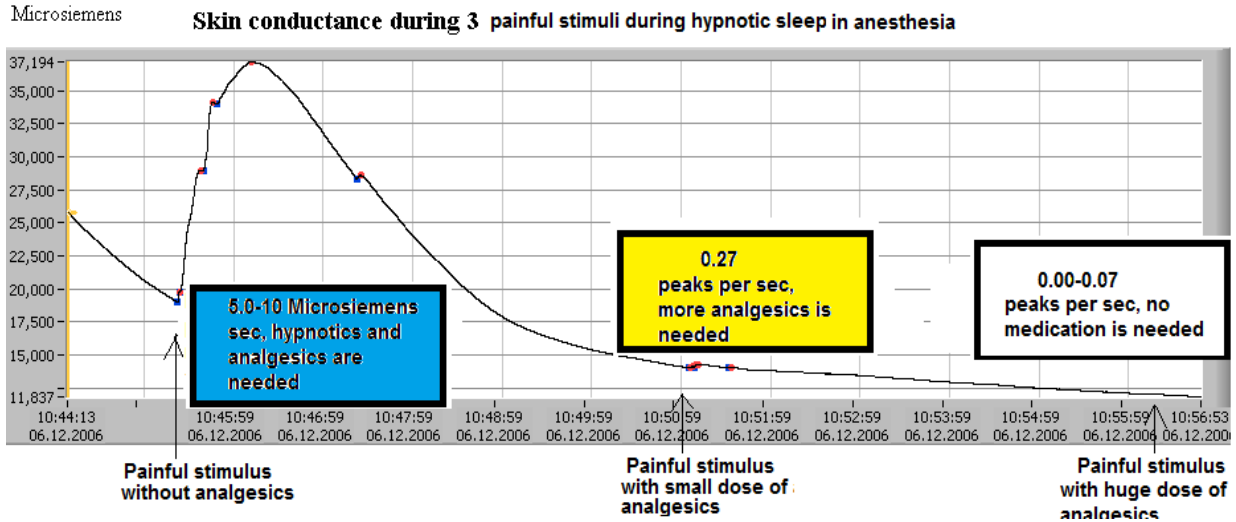
# *PainMonitor*™ - Clinical Validation




| | |
|---|---|
| **WHITE:**<br>**0.00 – 0.07 peaks per sec** | **No pain** |
| **LIGHT YELLOW: 0.13-0.21** | **No pain or VAS less than 40** |
| **YELLOW:**<br>**0.27 peaks per sec** | **Patient is active, can be pain VAS 40-50** |
| **ORANGE:**<br>**0.33 peaks per sec** | **Patient is possibly in pain, VAS 60-80, go and evaluate the situation** |
| **RED:**<br>**0.40-0.70 peaks per sec** | **The patient is probably in pain, VAS 80-100, go and find out how to help the patient** |

- **This graph and commentary show the Skin Conductance Algesimeter index for patients in intensive and postoperative care**, validated by Visual Analog pain Score (VAS), MAAS, and COMFORT sedation score, e.g. before, during and after suction from trachea in an artificial ventilated patient in ICU.
- When the VAS pain score is above 30, the Skin Conductance Algesimeter index has a sensitivity of 90% to discover postoperative pain, in both adults and children, different from blood pressure and heart rate. [500 patients studied].
- Giving analgesics postoperatively reduces pain and the Skin Conductance Algesimeter index accordingly.
- **The GE's surgical stress index is not developed for Intensive and postoperative care. GE has no equipment to monitor pain in these patients. The ANI index is influenced from respiratory rate (the parasympathetic nervous system influence respiration which again induce changes on heart rate variability assed by Metodoloris in the ANI index). The ANI index can therefore not be used safely during artificial ventilation when the physiological respiratory rate is blocked (not influenced by the parasympathetic nervous system).**

# *PainMonitor*™ - Clinical Validation




| | |
|---|---|
| **WHITE:** | **0.00-0.07 peaks per sec** |
| **LIGHT YELLOW:** | **0.14 peaks per sec, more analgesics needed** |
| **YELLOW:** | **0.21-0.027 peaks per sec, more analgesics needed** |
| **ORANGE:** | **0.33 peaks per sec, more analgesics needed** |
| **RED:** | **0.40 peaks per sec or more, more analgesics needed** |

- **Skin Conductance Algesimeter index: anesthesia validated by Surgical Stress Score, genes associated to the pain threshold, epinephrines, heart rate, blood pressure, and EEG monitors. (It is of high importance that the recommended pre-set threshold value of 0.005 microsiemens is used).**
- In anesthesia, studies show that when awakening from anesthesia huge bursts in the skin sympathetic nerves occur, mirrored by huge relative area under the skin conductance peak (Microsiemenssec), colored blue, and both analgesic and hypnotic drugs need to be administered. The peaks per sec scale is color coded from white to red and is associated with the need for analgesics.
- The pain response on the Skin Conductance Algesimeter monitors, is statistical significantly associated with the genetic pain threshold and may therefore predict the level postoperative acute pain, allowing prophylactic medical intervention.
- **The GE's surgical stress index is developed for anesthesia. The GE's surgical stress index is influenced from hypoxia, environmental temperature, or medication acting on blood circulation (such as beta-blockers and epinephrine) as well as respiratory rate and is therefore less sensitive and specific to nociceptive stimuli compared to the PainMonitor. The same arguments are valid for the ANI index.**

# *PainMonitor*™ - Market Needs 1/3

**Currently, No Objective System Nor 'Gold-standard' for the Assessment of Pain**

Currently, subjective scales are used to quantify pain, assessed by patient or observer reporting on a numerical rating scale:

- Visual analogue scale (VAS) – 0 to 100
- Verbal numerical rating scale (VNRS) 0 to 10,
- Faces, Legs, Activity, Cry, Consolability (FLACC).

For communication-deficient patients:

- Behavioural Pain Scale (BPS),
- Critical-Care Pain Observational Tool (CPOT)
- Pain Assessment & Intervention Notation (PAIN) Algorithm,
- Adult Non Verbal Pain Scale (NVPS).
- For preterm infants, there are numerous behavioural observational pain scores

There is a need for an Alert System when a patient should be evaluated for pain, thereby allowing physicians to monitor patients between assessments and to alert the care provider that the patient may be in pain for further diagnosis and treatment. Current methods of pain assessment and management are especially sub-optimal in non-communicative and communication-deficient patient(s); neonates who may be too weak to cry and other infants; patients under general anesthetic; patients in peri-/post-operative care; plus patients in ICU, PICU and NICU.

# *PainMonitor*™ - Market Needs 2/3

- Since a 2002 ruling, 5,500 US hospitals are mandated to manage pain according to JCAHO.
- 95 million patients/year require sedation.
- 200 million patients/year need chronic pain monitoring.
- 10 million patients/year need objective chronic pain diagnosis.
- In veterinary medicine: 5 million pets/year in the US are anesthetized.

| Segments | # of units | *PainMonitor*™ rationale |
|---|---|---|
| Respirators (ICUs) | 100 000 | Patients on respirator are unable to express pain. All these beds need a *PainMonitor*™. |
| Premature and Paediatrics | 100 000 | To monitor pain by e.g. *PainMonitor*™ has been suggested as good practice for determining pain for premature children by US Neonatal pain Control group. |
| Operating theatres | 100 000 | Patients in narcosis are unable to express pain. All these beds need a *PainMonitor*™. |
| Post-operative beds | 150 000 | 50% potential of beds are potential for *PainMonitor*™. |
| Procedural Sedation | 75 000 | *PainMonitor*™ will increase efficiency. |
| Total | 525 000 | The US market is approximately 50% of the global market. |

# *PainMonitor*™ - Market Needs 3/3

**Pain Monitoring Is Needed for Non-communicative and Communication-deficient Patients**

Pain in Infants

Significant and long-lasting physiological consequences can arise from pain experienced as an infant, including increased pain sensitivity, decreased immune system function leading to sepsis and even death, and altered infant development.

General Anaesthesia

Awareness in post- general anaesthesia is reported in 0.1-0.2% of the general population; this figure rises to 1% during emergency surgery . Further, patients describe paralysis, fear and pain in this setting and 50% of patients affected may develop post-traumatic stress disorder (PTSD). Tailoring analgesia during anaesthesia will give less side effects like postoperative nausea and respiratory depression.

Post-operative Pain

The under-treatment of post-operative pain can delay patient recovery and discharge from hospital; 50–70% of patients report moderate to severe pain post-operatively.  Acute pain is followed by persistent pain in 10-70% of patients. Ten percentage of the patients developing persistent pain are disabled from their pain.

Intensive Care

Pain is a common symptom in ICU patients, with up to 30% of ICU patients reporting being in pain during their stay in ICU. High doses of analgesics and sedatives can lead to prolonged need for ventilation. Such patients can develop PTSD, anxiety and depression.

# *PainMonitor*™ - Clinical Utility and Benefits to Patient and Physician 1/2

***PainMonitor*** **has utility in the medical management of patients under anaesthesia, in intensive care (ICU/PICU/NICU), for post-operative monitoring, for all types of patients: adults, children, neonates and preemies.**

**There is significant potential utility in the field of chronic pain and also in veterinary medicine.**

***PainMonitor*** **enables physicians to tailor a patient's individual need for short-acting analgesics (3 minutes time) used during anaesthesia and in intensive care. Further, the physician can reduce the amount of analgesic used in anaesthesia and, thus, side effects are avoided or diminished.**

***PainMonitor*** **is not influenced by anxiety in the postoperative setting, different from the reported pain and studies show that the PainMonitor is more accurate to assess pain than the reported pain during standardized stimuli in awake volonters.**

***PainMonitor*** **may be an important tool to reduce a patient's stay in the ICU, saving time and money for the patient and the healthcare system.**

***PainMonitor*** **may reduce the amount of analgesics that patients need postoperatively and thereby reduce risk of respiratory depression and associated death.**

# *PainMonitor*™ - Clinical Utility and Benefits to Patient and Physician 2/2

MED-STORM innovation

***PainMonitor*** **may be used to assist in diagnosing whether [i] chronic pain has an emotional, cognitive or somatic component, [ii] the treatment of chronic pain is working satisfactorily.**

***PainMonitor*** **may be used to develop a pain response test during anaesthesia to predict the level of acute post-operative pain.**

***PainMonitor*** **may be used in preterm infants to diagnose whether peripheral desaturation is caused by general hypoxia or pain.**

***PainMonitor*** **may affect pain treatments that reduce pain/discomfort levels for infants from 25 weeks of gestational age and thereby reduce the risk of intraventricular bleedings (leading to cerebral pareses), reduce the incidence of sepsis, increase the well-being of the patient later in life, and reduce the length of stay in hospital.**

**Because environmental temperature, hypovolemia (after e.g. bleedings), medication acting on blood circulation (e.g. epinephrines or beta blockers), respiratory rhythm and apnea do not influence the *PainMonitor* data analysis,, it is therefore more accurate than measuring blood pressure and heart rate, in assessing pain in these underserved patient groups.**

# Med-Storm – Management Team

**Hanne Storm, Chief Scientific Officer and Founder (Shareowner: 35%)**

**Hanne Storm is the scientific founder of Med-Storm. Since 2001 she has allocated up to 100% of her available time to the development of the PainMonitor™. Dr. Storm studied medicine and trained as a physician at the University of Oslo and has been doing research for the last 15 years. She received her PhD in 1996.**

**Hanne Storm is Professor and Head of the Skill Training Centre, Medical Faculty, University of Oslo.**

# Med-Storm – Board of Directors

**Henrik Mindedal, Chairman, is currently General Manager and Director of MedTech West. Before assuming the responsibilities at Medtech West, Henrik Mindedal held executive management positions with Samba AS, a Swedish sensor technology company. Henrik has broad business experience from industry with companies such as Siemens-Elema AB, A-Plus Science and Innoventus AB (a Technology Transfer Office of Uppsala University).**

**Erlend Skagseth, Board Member, is currently a Partner at Sarsia Seed, a leading Norwegian venture fund specializing in early-stage investments in the life science area. Erlend Skagseth brings 20 years of experience from R&D based IPR, project- and business development from Christian Michelsen Research, Forinnova and Sarsia Innovation. Erlend has managed several turnaround processes and negotiated a large number of international contracts, licenses and trade exits. He has extensive experience as board member in numerous technology-intensive early-stage companies. Sarsia Seed is a shareholder in Med-Storm.**

**Barry Zuckerman, Board Member (Shareowner: 5%), is MD and head of the Dept. of Pediatrics at Boston Medical Centre. He has more than 35 years' clinical experience working in anaesthesia. Dr. Zuckerman is considered to be the US leading expert with pain management for children.**

**Jens Gran, Board Member (Shareowner: 35%), is co-founder of Med-Storm and has been working as a part-time advisor with business development and commercialization since 2003. Jens Gran holds an MSc in both engineering and finance and has 20 years' experience in corporate finance and general business development. Jens Gran is currently employed at Standards Norway, focusing on developing industrial standardization.**