A Novel Framework for Pain Management & Control

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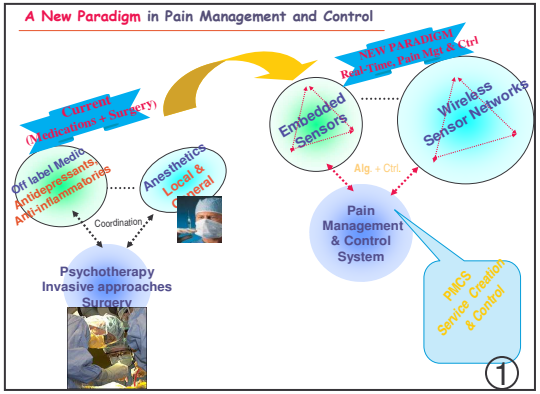
A New Paradigm in Pain Management and Control



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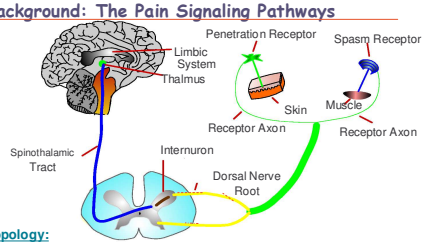
Background: The Pain Signaling Pathways



Topology:

- Sense Receptors Planted Throughout Our Bodies (Pain/Pst/Tmp/Vib/MsC Nerves)
- Receptors Stimulated by Damage Tissues ~ Tearing, Fracturing, Burning, …
- Receptors interconnected via network of nerves that run to Central Nervous System

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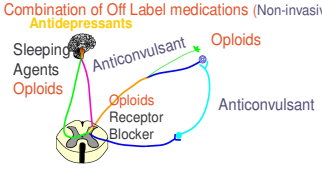
Background: Temporary Relief from Pain

Type 1 Relief: Combination of Off Label medications (Non-invasive Procedures)



Type 2 Relief: Block Joints (Invasive Procedures)

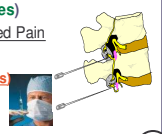
Assume Facet Joints are Source of Spinal related Pain

① Inject Joints with anesthetic + "Steroids"

Burns the "Medial" Dorsal Nerve Endings (Receptors)

Causes Interrupt of Pain Signal Flow

Temporary Relief of Pain



② When Receptors re-grow after *X* months → **Pain Resumes**

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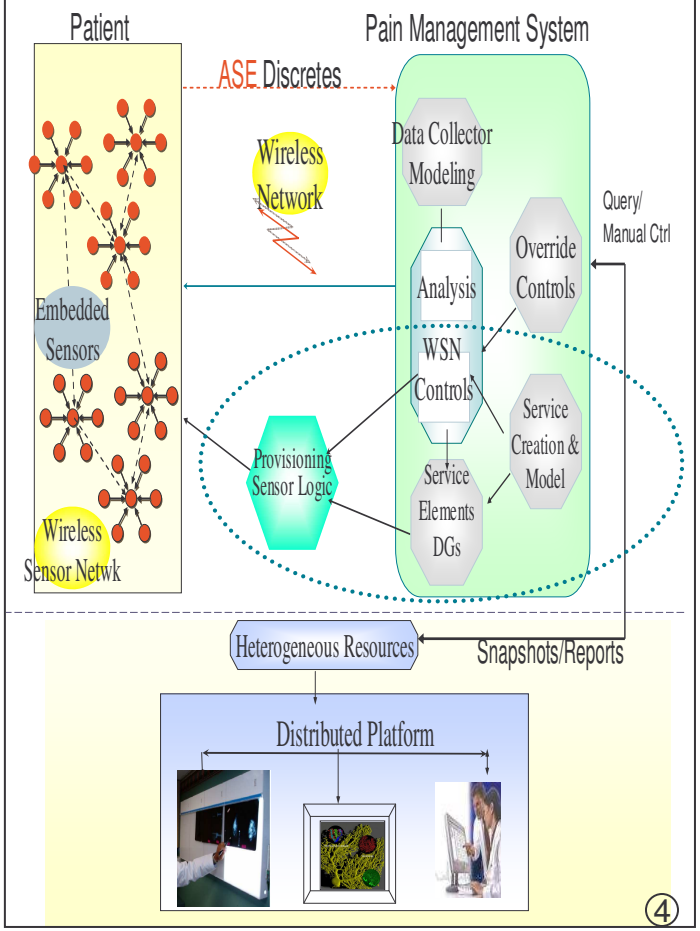
Pain Management & Control: End-to-End Communications Infrastructure



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Key Enabling Technologies ~ Medical Informatics Research

Embedded Sensors

- Abstraction of Receptors (Pain, Touch, Temperature,..)
- Layered Architecture (Compute, Communicate, Actuate)
- Energy levels

Wireless Sensor Networks

- Modeling and Simulation of Signaling Pathways
- Communications Protocols
- State Machines & Bayesian Modeling

Wireless Networks

- Communications Protocols
- Multiple Access channels:
- Transport capacity

Real-Time Pain Management System

- Layered Architecture
- Platform Independence
- Sensor Network Analysis & Control
- Provisioning
- Activation & Removal of Control Signals

Service Creation System

- Logic, Decision Graphs and Controls
- Control Signals:
- Criteria for Control Activation & Removal

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What about Industry?

- Industry has history of
  - forging new research and technology directions and
  - adapting and productizing technology which has demonstrated promise
- Need to strengthen the joint academia/industry research collaborations; joint projects / early stages
- Technology transfer
  - Establish path for tech transfer from academic research to industry
  - Joint projects, faculty, students (academe <----> industry)
- Success Stories: Networking, Parallel and Scalable Computing,
- Industry is interested in Pain Management Technology

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