



Spinal Neuromodulation

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Regional Anaesthesia
& Pain Therapy

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Spinal Neuromodulation

What are we talking about

- Electric
- Pharmacologic



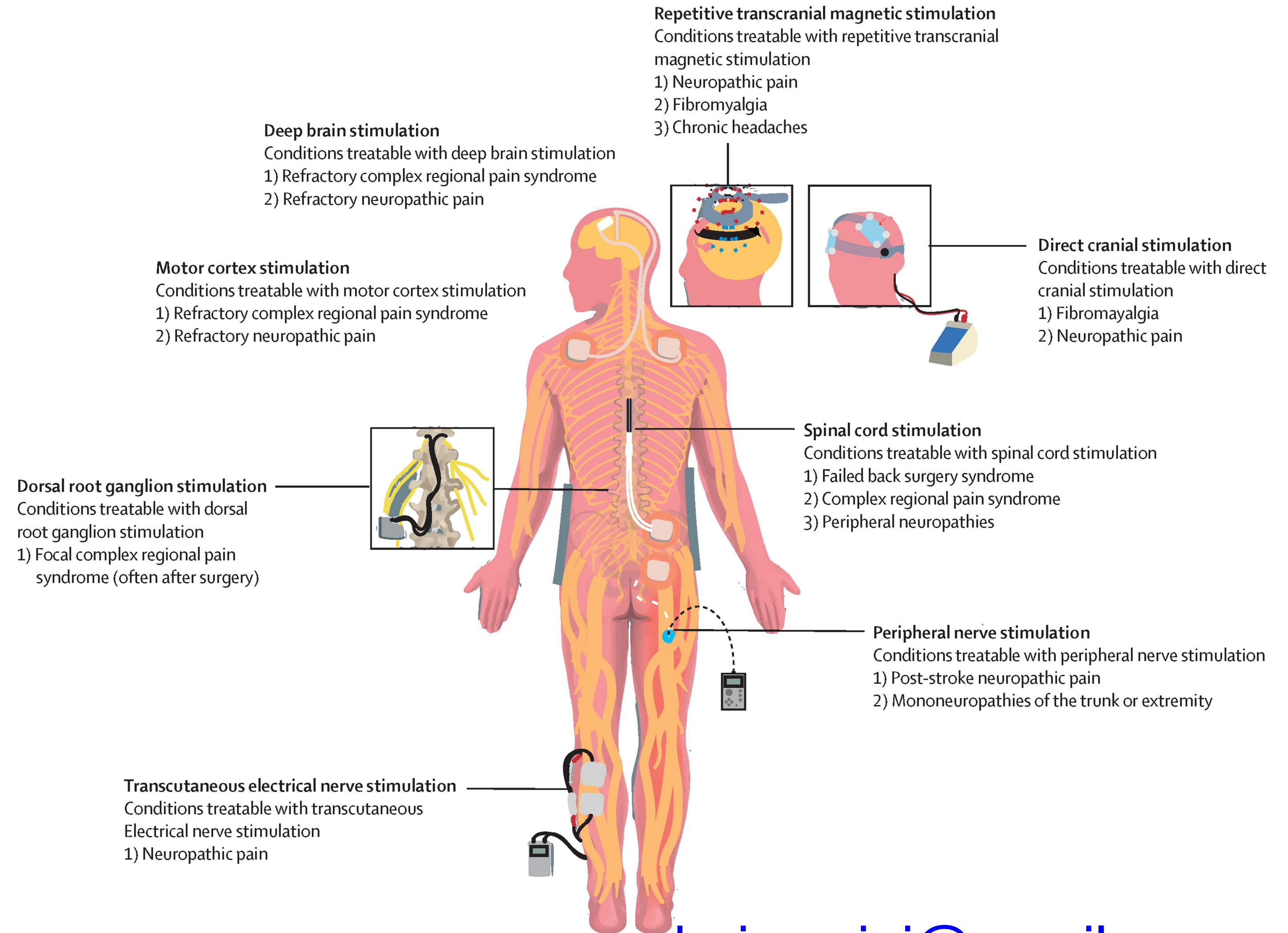
Spinal Neuromodulation

What are we talking about

Review > Lancet. 2021 May 29;397(10289):2111-2124. doi: 10.1016/S0140-6736(21)00794-7.

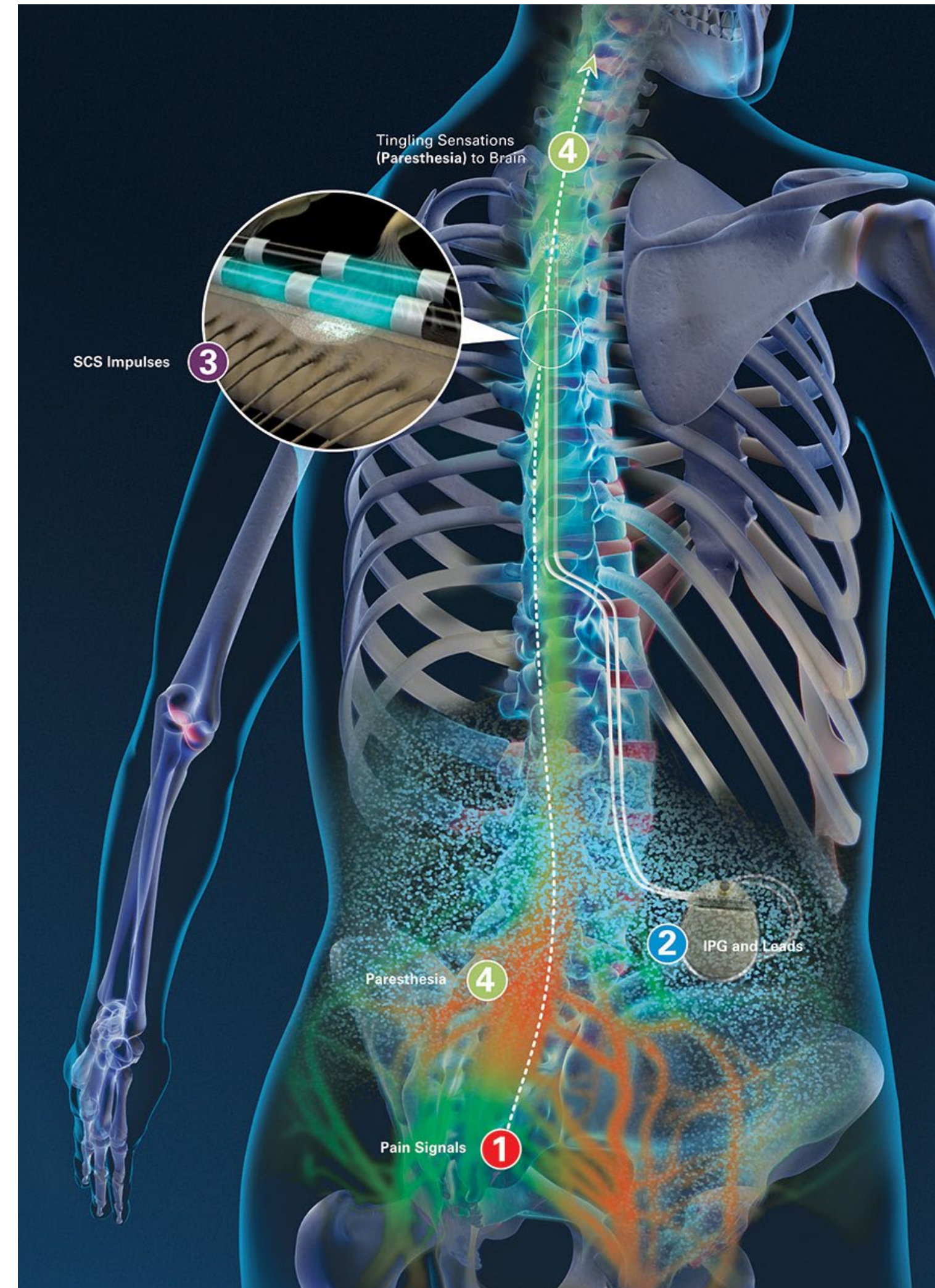
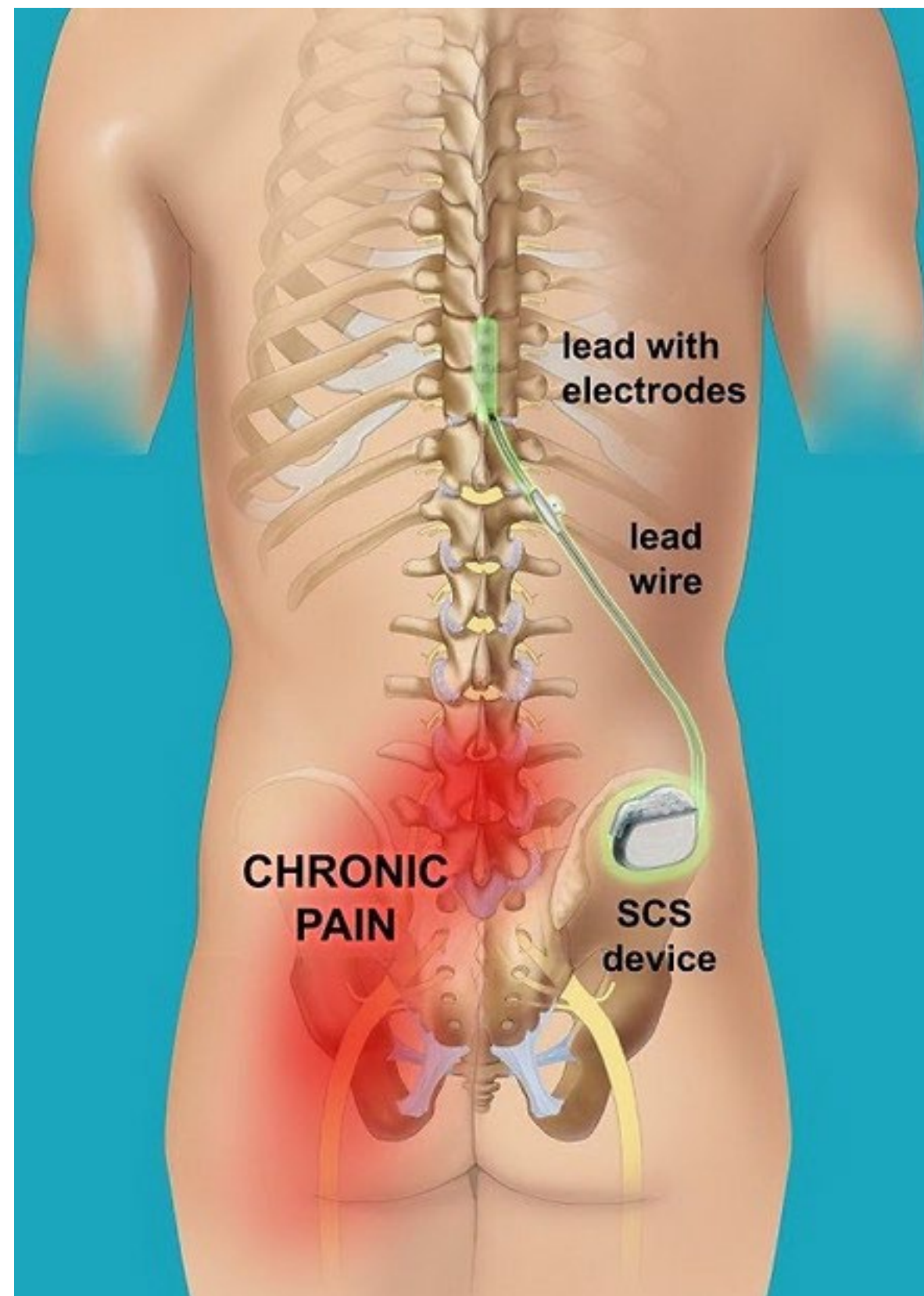
Neuromodulation for chronic pain

Helena Knotkova¹, Clement Hamani², Eellan Sivanesan³, María Francisca Elgueta Le Beuffe⁴, Jee Youn Moon⁵, Steven P Cohen⁶, Marc A Huntoon⁷



Spinal Neuromodulation

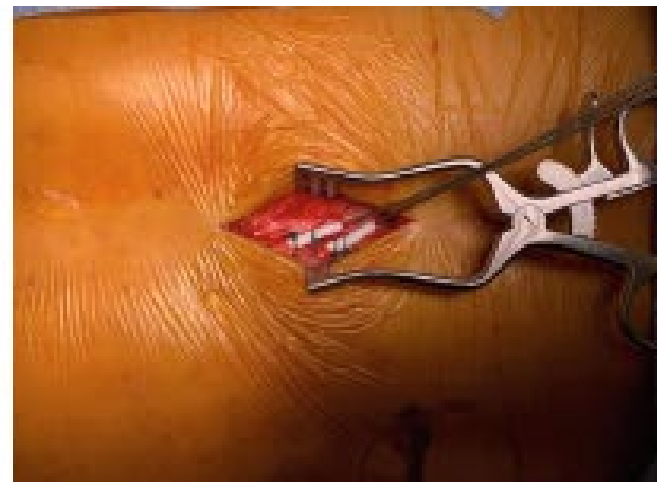
What are we talking about



Spinal Neuromodulation

What are we talking about

- Trial



Spinal Neuromodulation

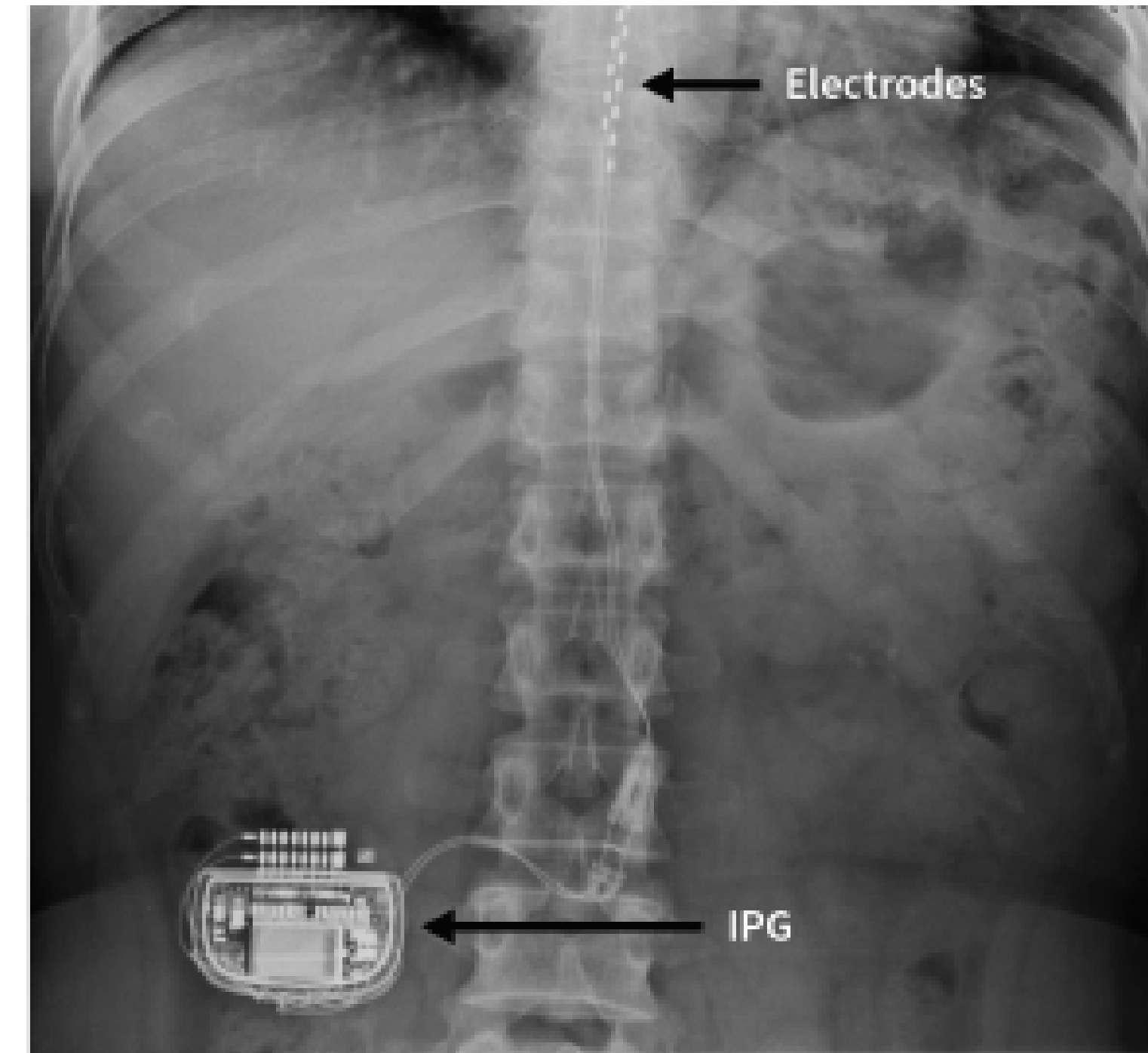
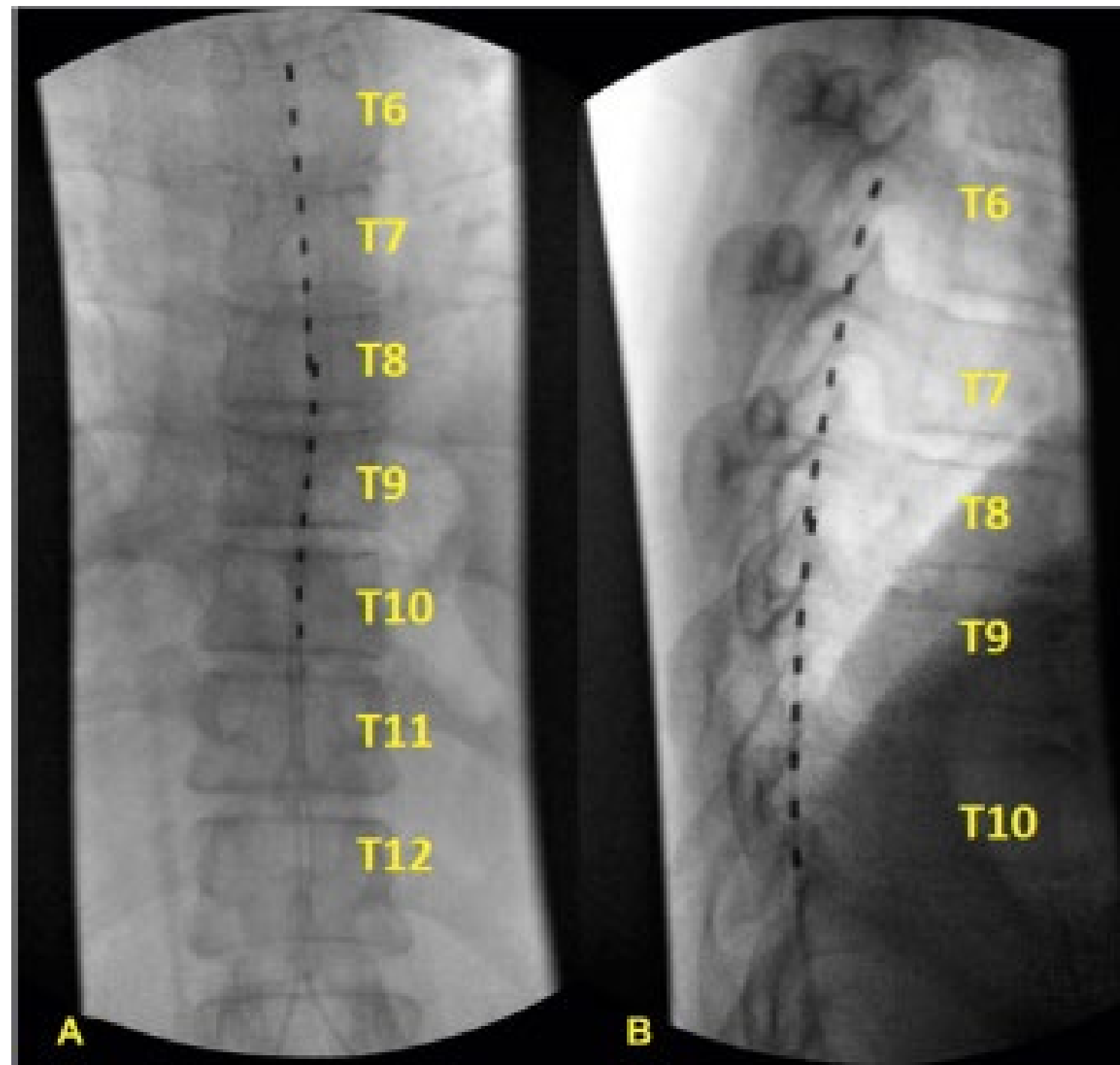
What are we talking about

- IPG



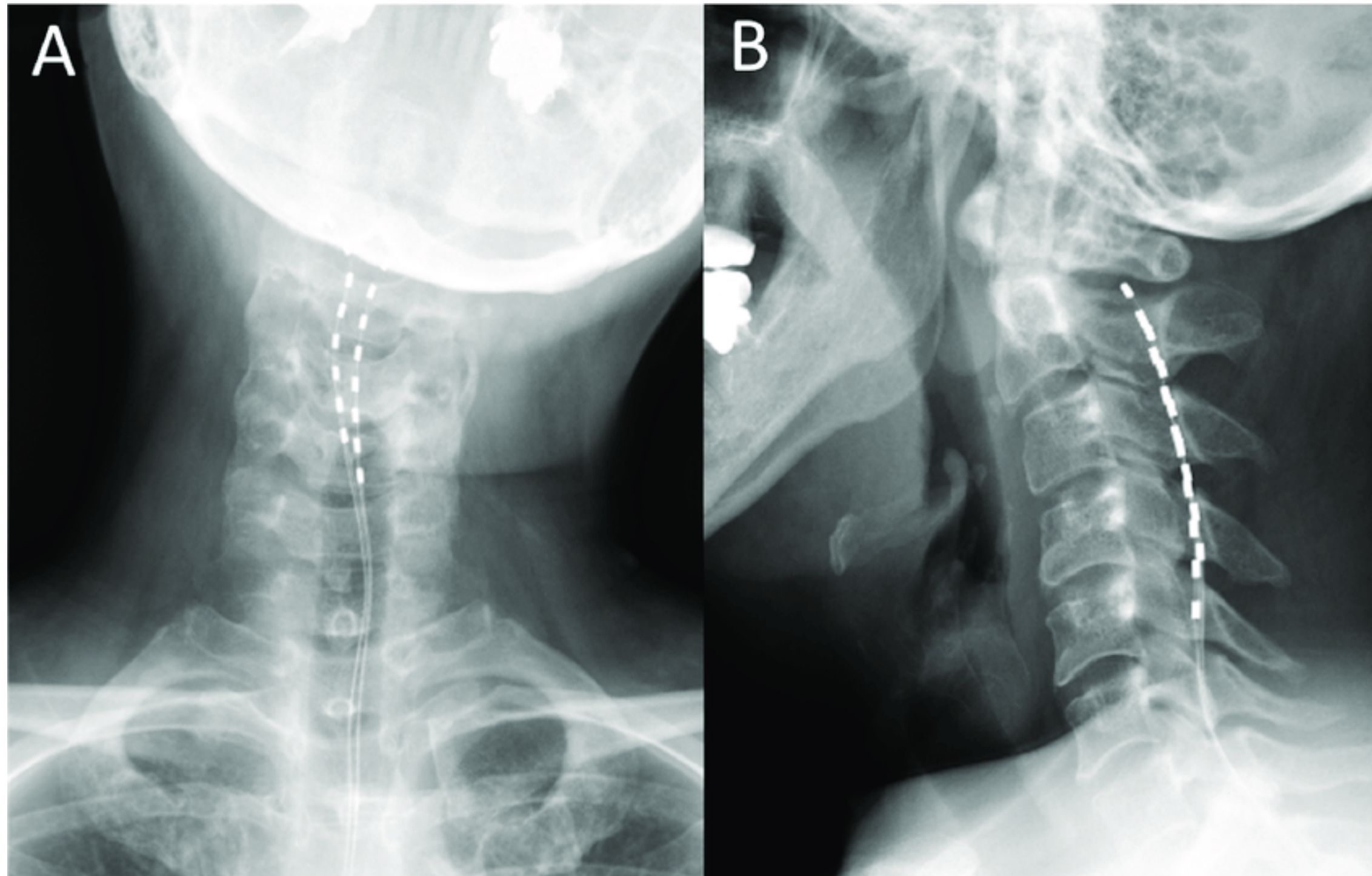
Spinal Neuromodulation

What are we talking about



Spinal Neuromodulation

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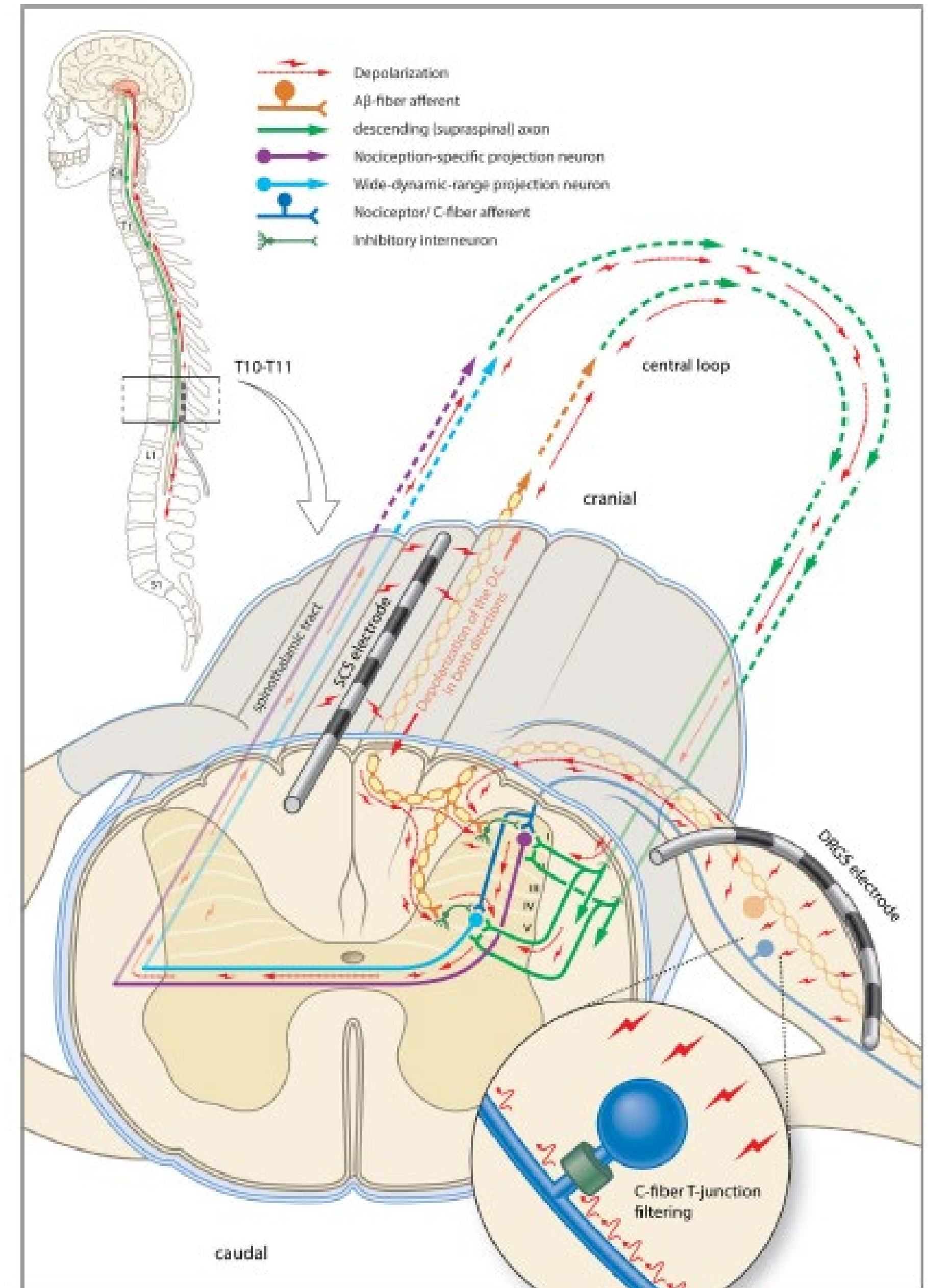
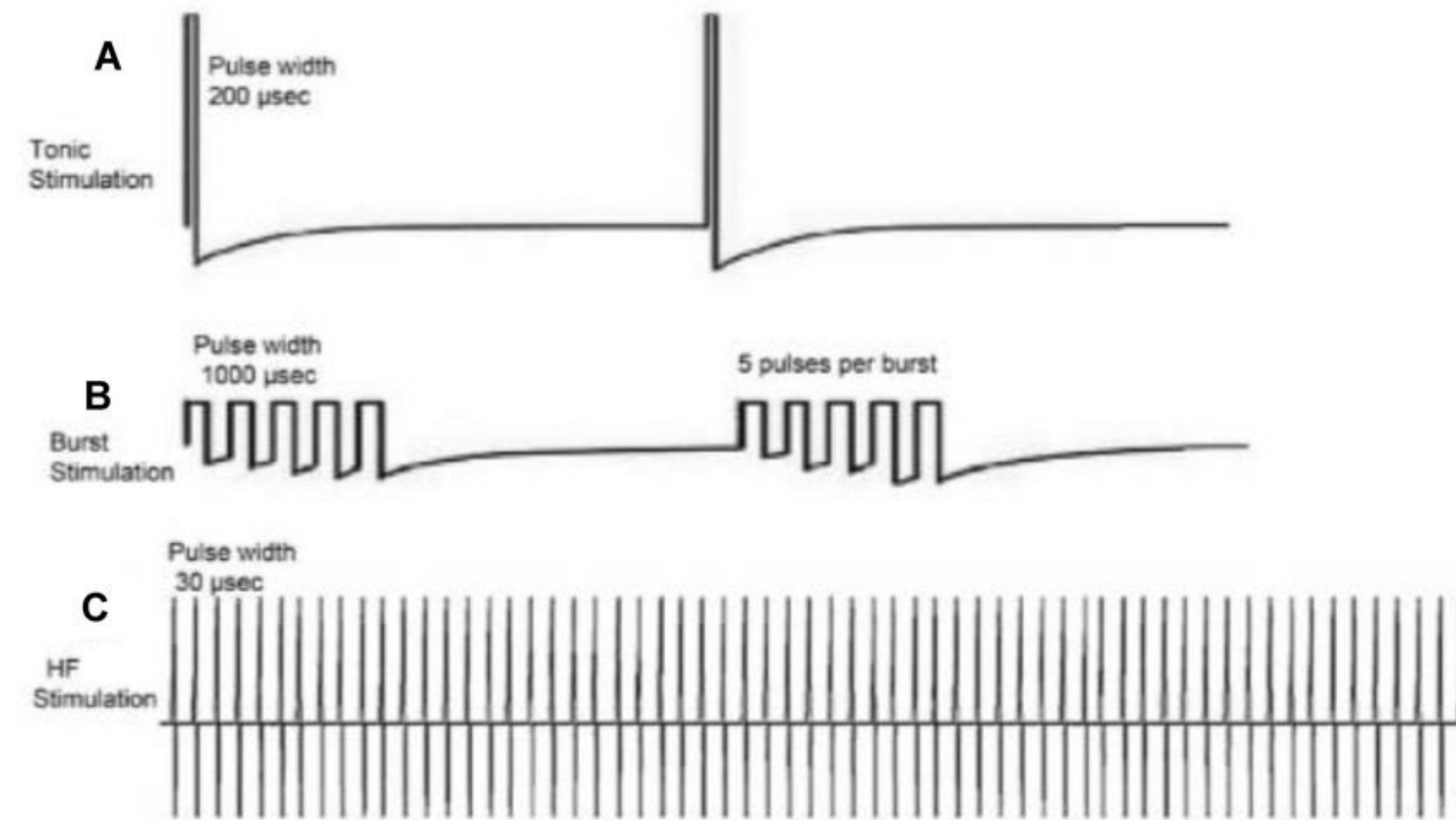
- Where?

Pain Location	Lead Tip Level
Foot only	T11–L1 (L1)
Anterior thigh	T11–T12
Posterior thigh	T11–L1
Perineum	T11–L1 (midline)
Buttock and lower extremity	T9–T10 (T11–L1)
Lower back	T9–T10 (midline)
Upper chest wall	T1–T2
Upper extremity	C3–C5
Hand	C5–C6
Shoulder	C2–C4
Neck	C1–C2
Jaw	C2

Spinal Neuromodulation

How it works

- Spinal
- Supra Spinal



HHS Public Access
Author manuscript
Pain Pract. Author manuscript; available in PMC 2019 February 27.

Published in final edited form as:
Pain Pract. 2018 November ; 18(8): 1048–1067. doi:10.1111/papr.12692.

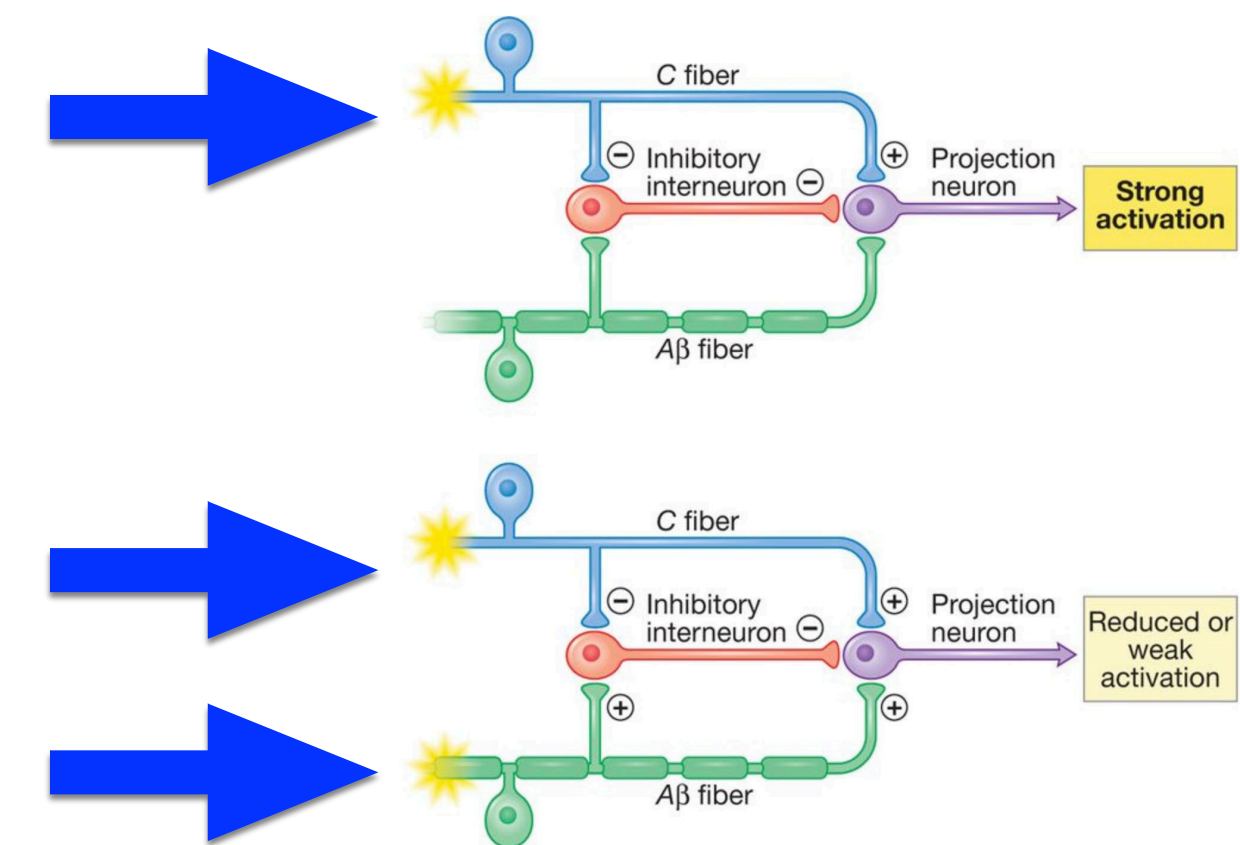
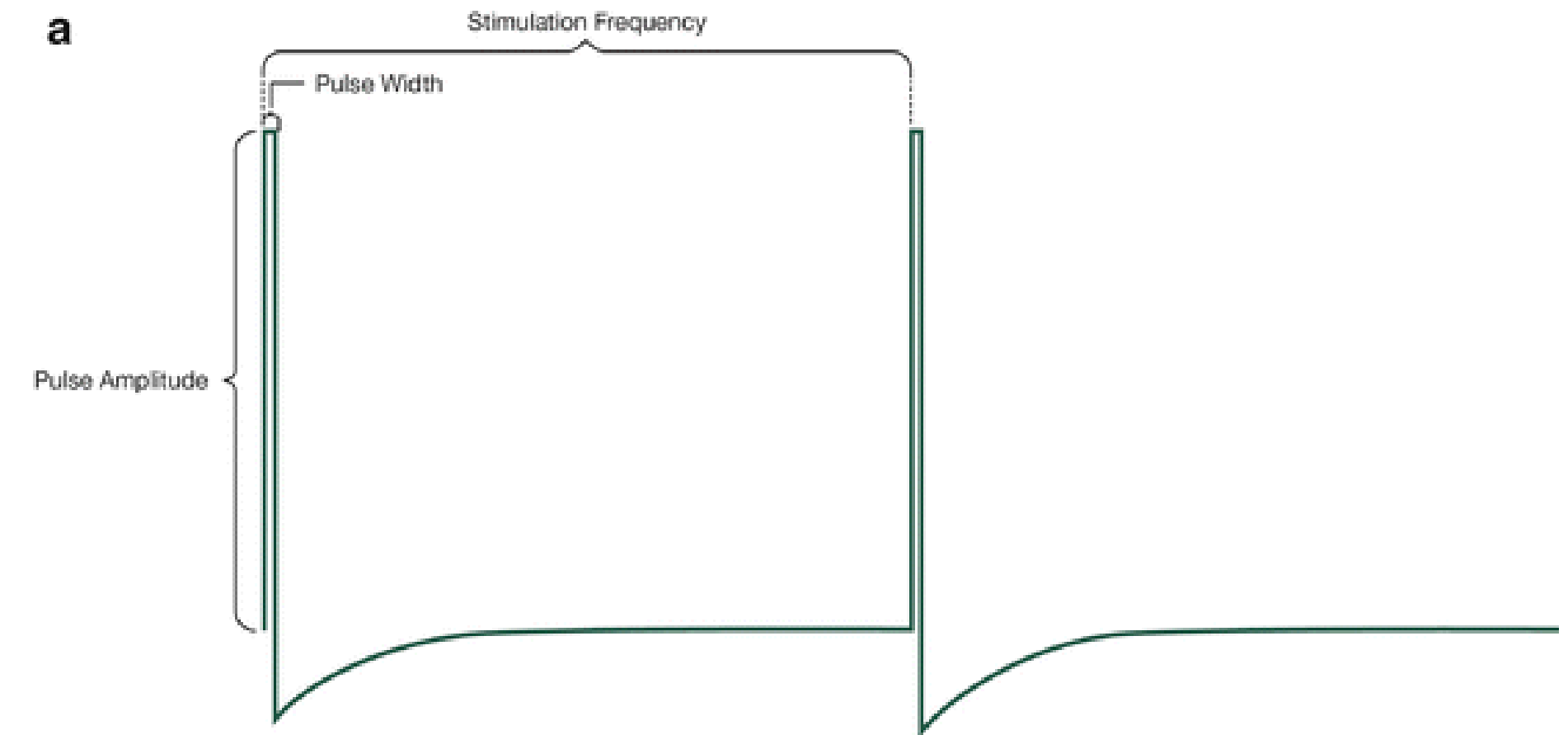
Spinal Cord Stimulation: Clinical Efficacy and Potential Mechanisms

AD Sdrulla¹, Y Guan^{2,3}, and SN Raja²

Spinal Neuromodulation

Conventional (Tonic)

- 30-80 Hz, 100-500 μ sec
- Gate Control (GABA Interneurons)
- Central sensitization (NMDA antagonism, CB1 stimulation)
- Orthodromic effect (spinotalamic tract, thalamus, cortex), 5-Ht modulation
- Paresthesia, tolerance



Spinal Neuromodulation

High Frequency

- 1000-10000 Hz, 30 μ sec, 1-5mA
- Electrochemical disturbance in spinal cord and DR entry zone
- Desynchronization C fibers and nociceptive neurons
- Temporal summation
- Depolarization blockade
- WDR neurons

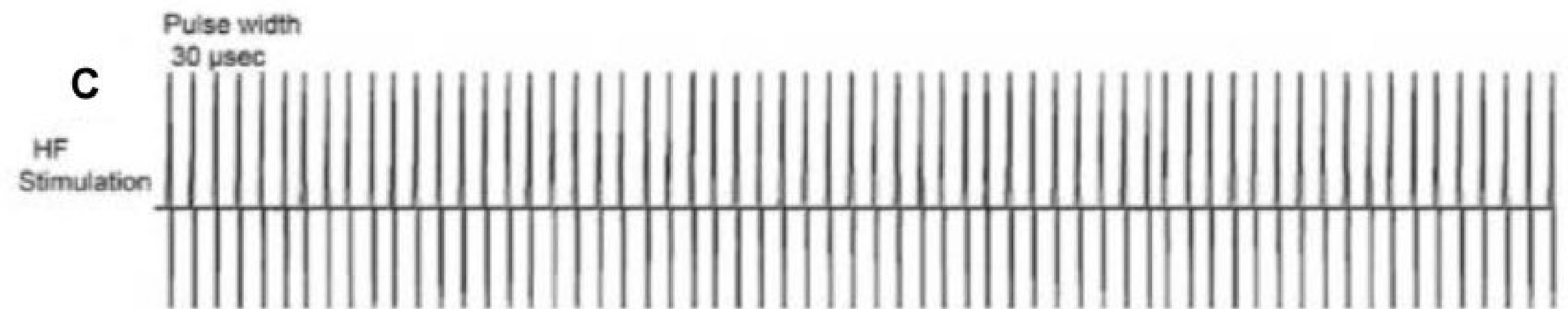
Biennial Review of Pain

PAIN

OPEN

Spinal cord stimulation in chronic neuropathic pain: mechanisms of action, new locations, new paradigms

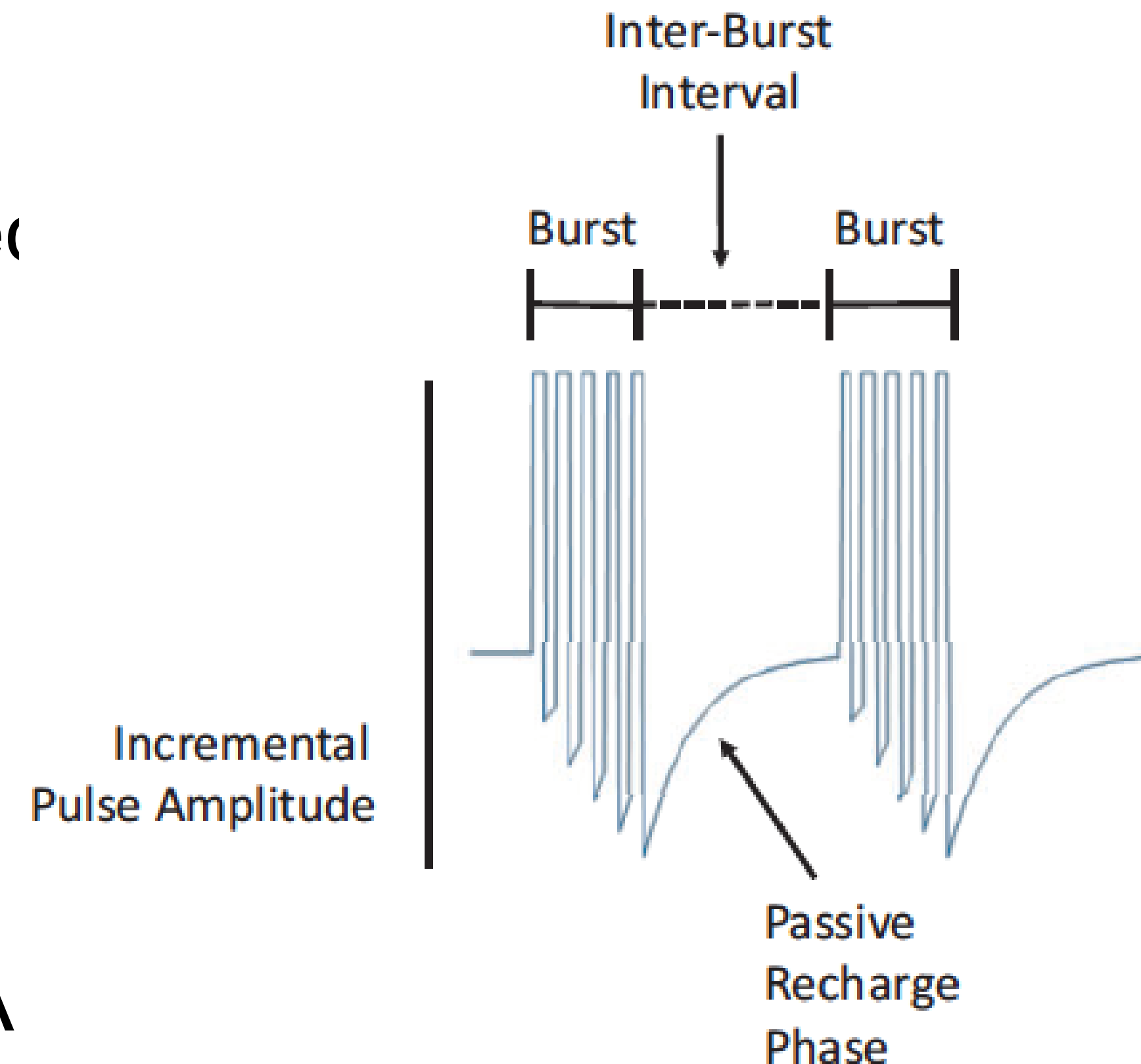
E.A. Joosten, G. Franken • 161 (2020) S104–S113



Spinal Neuromodulation

Burst

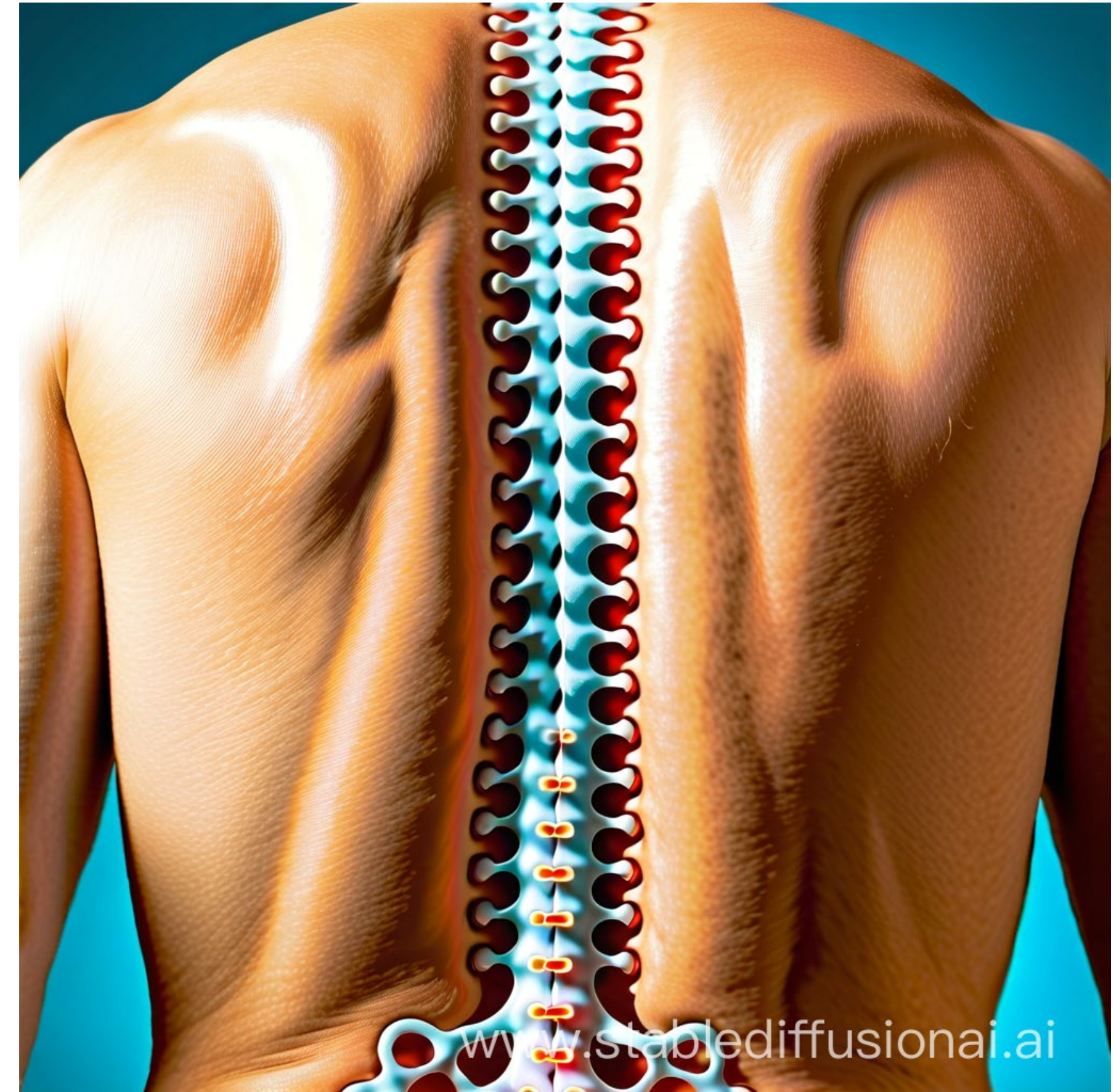
- 40 Hz inter burst-500 Hz intraburst, 1 msec burst width
- Mimic naturally neural bursting patterns
- I-STT (cortex) and m—SST (limbic)
- Spinal mechanism (GABA)
- Inhibiting descending pathways (5-HT, NA



Spinal Neuromodulation

Main clinical indications

- Failed back surgery syndrome
- Complex regional pain Syndrome
- Chronic peripheral neuropathy
- Intractable angina
- Peripheral artery disease



Spinal Neuromodulation

Main clinical indications

- Persistent spinal pain syndrome (PKA FBSS)
- Complex regional pain Syndrome
- Chronic peripheral neuropathy
- Intractable angina
- Peripheral artery disease

Spinal Neuromodulation

Early Complications

- Infections (epidural abscess)
- Bleeding
- Dural Puncture
- Neural damage

Review > [J Pain Res.](#) 2023 Mar 9;16:761-772. doi: 10.2147/JPR.S396215. eCollection 2023.

Interventional Pain Procedures: A Narrative Review Focusing On Safety and Complications. PART 2 Interventional Procedures For Back Pain

Giuliano Lo Bianco^{1 2}, Andrea Tinnirello³, Alfonso Papa⁴, Maurizio Marchesini⁵, Miles Day⁶,
Gaetano Joseph Palumbo⁷, Gaetano Terranova⁸, Maria Teresa Di Dato⁴, Simon J Thomson⁹,
Michael E Schatman^{10 11}

Spinal Neuromodulation

Late Complications

- Hardware malfunction (lead fracture, battery failure, others)
- Lead migration (20%)
- Pocket pain
- Skin erosion

Review > [J Pain Res.](#) 2023 Mar 9;16:761-772. doi: 10.2147/JPR.S396215. eCollection 2023.

Interventional Pain Procedures: A Narrative Review Focusing On Safety and Complications. PART 2 Interventional Procedures For Back Pain

Giuliano Lo Bianco^{1, 2}, Andrea Tinnirello³, Alfonso Papa⁴, Maurizio Marchesini⁵, Miles Day⁶,
Gaetano Joseph Palumbo⁷, Gaetano Terranova⁸, Maria Teresa Di Dato⁴, Simon J Thomson⁹,
Michael E Schatman^{10, 11}

Spinal Neuromodulation

Future?

> [J Clin Orthop Trauma](#). 2023 Jul 29;43:102210. doi: 10.1016/j.jcot.2023.102210.
eCollection 2023 Aug.

Spinal cord stimulation for spinal cord injury – Where do we stand? A narrative review

[Anuj Mundra](#)¹, [Kalyan Varma Kalidindi](#)², [Harvinder Singh Chhabra](#)¹, [Jitesh Manghwani](#)³

Affiliations + expand

PMID: 37663171 PMID: PMC10470322 (available on 2024-07-29)

DOI: [10.1016/j.jcot.2023.102210](https://doi.org/10.1016/j.jcot.2023.102210)

Abstract

Recovery of function following a complete spinal cord injury (SCI) or an incomplete SCI where recovery has plateaued still eludes us despite extensive research. Epidural spinal cord stimulation (SCS) was initially used for managing neuropathic pain. It has subsequently demonstrated improvement in motor function in otherwise non-recovering chronic spinal cord injury in animal and human trials. The mechanisms of how it is precisely effective in doing so will need further research, which would help refine the technology for broader application. Transcutaneous spinal cord stimulation (TSCS) is also emerging as a modality to improve the functional outcome in SCI individuals, especially when coupled with appropriate rehabilitation. Apart from motor recovery, ESCS and TSCS have also shown improvement in autonomic, metabolic, genitourinary, and pulmonary function. Since the literature on this is still in its infancy, with no large-scale randomised trials and different studies using different protocols in a wide range of patients, a review of the present literature is imperative to better understand the latest developments in this field. This article examines the existing literature on the use of SCS for SCI individuals with the purpose of enabling functional recovery. It also examines the voids in the present research, thus providing future directions.

Spinal Neuromodulation

Take home message

- Spinal cord stimulation is an established treatment option for some chronic pain condition
- New algorithms seems promising in treating axial pain and other neuropathic pain disease
- Research is identifying new scenarios for SCS as part of a rehabilitative multimodal approach

Thank you



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10 CREDITI
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Responsabili Scientifici: Dott.ssa Stefania Taddei, Dott. Emanuele Piraccini

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