

# ***STIMULATION MEDULLAIRE : INDICATION ET SELECTION DES PATIENTS***

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# NEUROCHIRURGIE DE LA DOULEUR

## INTRODUCTION

- La chirurgie de la douleur connaît un grand progrès grâce aux avancées technologiques
- Elle bénéficie d'une meilleure compréhension des mécanismes générateurs de la douleur et d'une meilleure précision des cibles thérapeutiques
- Une sélection rigoureuse pré chirurgicale des patients dans un cadre multidisciplinaire offre une meilleure réflexion thérapeutique et des meilleurs résultats

# Définitions

- Douleur

une expérience sensorielle et émotionnelle désagréable associée à une lésion tissulaire réelle ou potentielle ou décrite dans ces termes

**International Association for the Study of Pain. IASP**

# Définitions:

- Douleur chronique

une douleur persistant au-delà du temps habituel de guérison, entre 3 et 6 mois .

**International Association for the Study of Pain. IASP**

# Définitions:

- Douleur chronique réfractaire:

symptôme dont la perception est insupportable et qui ne peut être soulagé en dépit des efforts obstinés pour trouver un protocole thérapeutique adapté sans compromettre la conscience du patient

# STIMULATION MEDULLAIRE

## Définition- objectifs

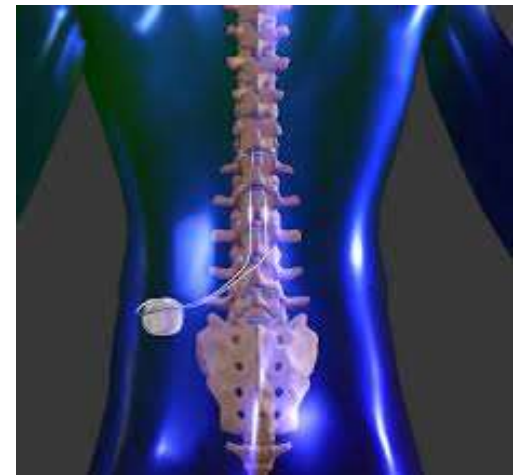
« Améliorer la fonction normale ou réduire les dysfonctionnements en modulant les propriétés chimiques et électriques du système nerveux »



Surgical electrodes



Neurostimulator

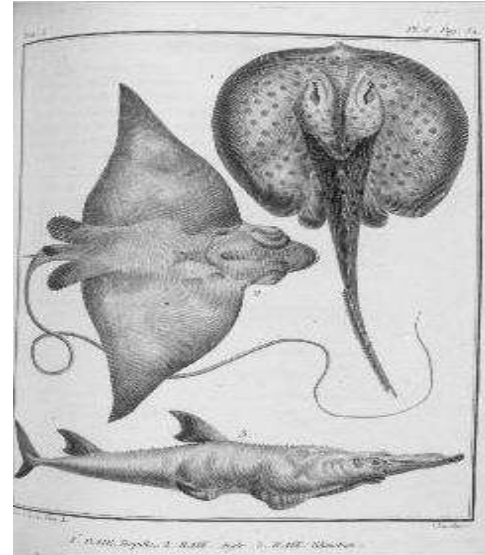


# History of electricity used for pain treatment

## Electrical methods used in

## Medicine before J.C

- **Electric fish**
- Antic Egypt, 2750 before J.C
- Hippocrate, 460-377 before JC
- Greek scholars, 469 before J.C
- Scribonius Largus, Rome , 46 before J.C



# History of electricity used for pain treatment

## Electrical Apparatus used in Medicine before 1900

Christian Gottlieb Kratzenstein ( 1744 )  
 Cavallo ( 1771)  
 Jean Paul Marat ( 1743-1793)

663 Photo-top. Soc. Med. Volume 70 September 1877



Fig. 11. Barthez (standing) and Fremont (seated) by courtesy of the Wellcome Trust

Theodor von Middeldorff of Berlin, who published a pamphlet on the subject in 1834. A list of galvanostatic apparatus designed by Middeldorff can be seen in the Wellcome Collection in London (Fig. 12).

Electrical Alternatives Methods in Medicine: Etiology of the Rheumatic and neural examinations of accessible body cavities, dates back to 1807, when the first recorded attempt was made by Philippe Ricard (1771-1809), physician, Jassy. The first electrically illuminated instrument was devised by Max Nixie (1848-1908) in 1876, and used as a machine soon. By 1877 the idea had been developed so far that a working apparatus for the examination of the ureters, bladder and testes was constructed.

Electro-physiology: In 1817 Augustus Derosé Walker (1816-1822) demonstrated the electric current changes accompanying the heart beat in man (Walker 1817). Walker worked at St Mary's Hospital Medical School between 1814 and 1820, starting as a lecturer in physiology and ending as head of the department.

During that time he employed the capillary electrometer, devised by Gabriel Lippman in 1873, to record heart currents in a manner that could be photographed. He used his pen holding, firmly, on his work.

With his apparatus Walker made the first recording of electrical activity associated with the human heart beat. Initially he called the record an 'electrogram', but a year later in a lecture at St Mary's Hospital Medical School he referred to the records as 'cardiograms'. The word 'electrocardiogram' was introduced later by Einthoven, who first employed the string galvanometer as a method of electrical recording in 1903. Walker held the honours as he one of the first two consultant physicians appointed to the National Heart Hospital in West-berkeley Green, London.

Force: In December 1895, Professor Rintgen published his discovery of the galvanostatic effects of the rays from a Crookes tube when electrically excited. Probably no other scientific discovery has ever ranked so much widespread and momentous attention. In his Radio lectures, given at the University of Cambridge on 19 June 1906, J.J. Thompson spotted him subject as follows:

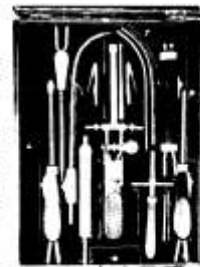


Fig. 12. Galvanostatic apparatus and apparatus designed by J.J. von Middeldorff by courtesy of the Wellcome Trust

Section of the History of Medicine

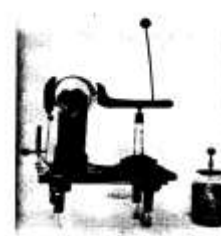


Fig. 1. John Wesley's apparatus (by courtesy of Philip Pinchard, London)



Fig. 2. A device for passing charges through a tooth in order to treat toothache (by courtesy of the Wellcome Trust)



Fig. 4. Adam's electrostatic machine in use for medical purposes (by courtesy of the Wellcome Trust)

At the same time another well-known figure, John Wesley (1703-1791) the founder of Methodism, practised Franklinian (Lover 1930), John Wesley's apparatus (Fig. 3) can still be seen at the Wesley Museum, London. On the right is a Leyden jar and on the left an electrostatic generator. Fig. 4 shows how the apparatus was used (Adams 1783). One of the 417 books Wesley published was entitled *Practical Physics*. It shows that electrocution in a proper manner cures such things as Mithridata, scorpions, shrews, mice, leeches, snakes, chameleons, squirts and even toothache. Fig. 5 shows a

device for passing electric charges through the tooth to treat toothache (Cavallo 1771). Another well-known figure to employ electricity in medicine was Jean Paul Marat, the French revolutionist who was a physician (Bell 1997).

The Middlesex Hospital was probably the first hospital to purchase an electrostatic machine. Fig. 6 shows the entry made by the Weekly Board on Tuesday 30 November 1767, when Mr Wynn requested the Board that from his own knowledge several very bad cases had been cured and others greatly relieved by electricity. In the following week an electrical apparatus was purchased for five guineas.

In 1796 a quack, James Graham of Edinburgh, practised himself the President of the Council of Health. Fig. 7 shows an advertisement by Graham for his 'Gilded Electrical Apparatus' (Graham 1796). One of his inventions was the 'vaccinated beef'. It was an elaborate structure supported on thirty glass pillars, and equipped with a variety of electrical devices. It was guaranteed to provide an absolute guarantee for the barren. An alternative name used by Graham was the 'medico-magneto-chemical electrical bed'.

Devices in electrocution, both genuine and fraudulent, have included the lightning con-

Localized electrification  
 Duchenne (1887)

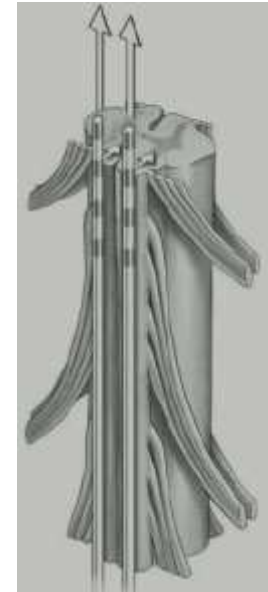
John Wesley's apparatus (1703-1791)  
 Adam's electrostatic machine (1785)



# Contemporary application of electricity in the treatment of neuropathic pain

## Spinal cord stimulation

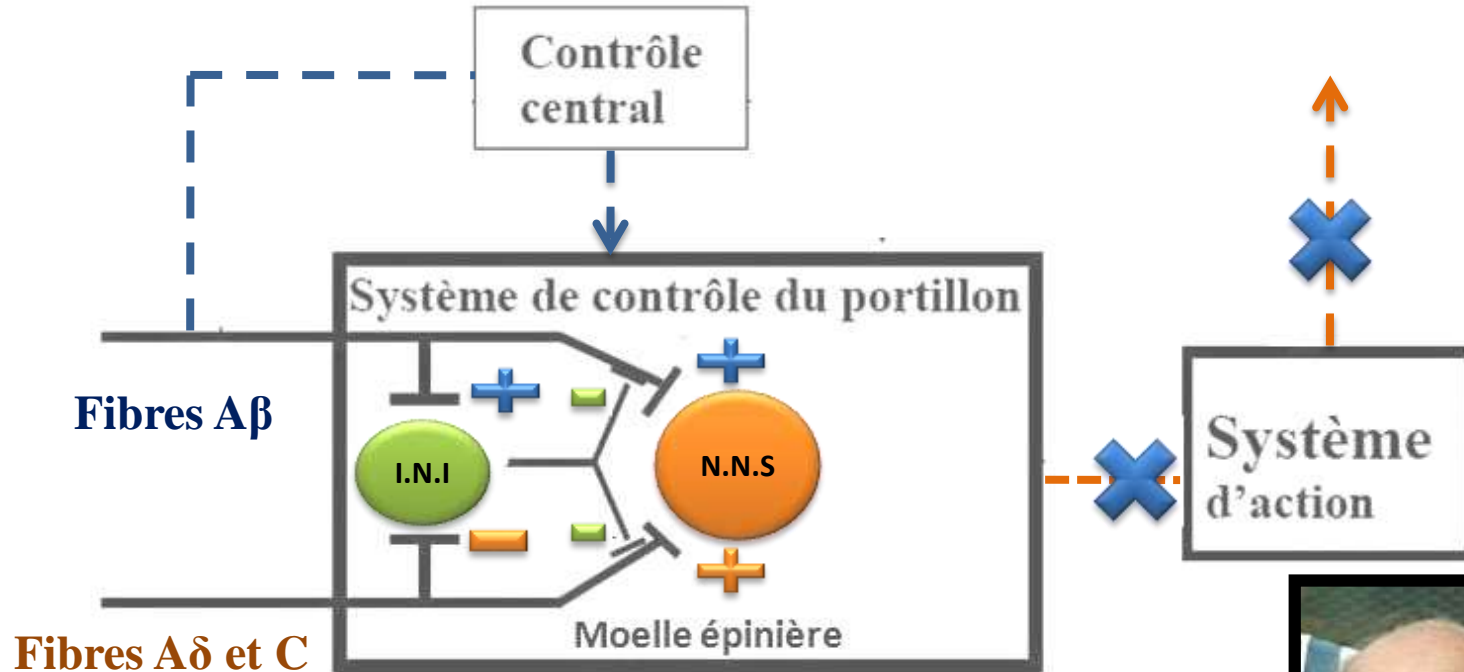
Shealy et al. In 1967



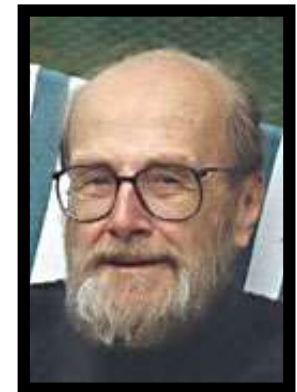
Electrodes → subdural → intradural → epidural

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The “gate control” theory



Mecanism of action



Melzak R,Wall PD (1965)

# STIMULATION MEDULLAIRE

## Critères généraux de sélection

- A quel moment orienter vers la chirurgie ? - Timing
- Nécessité d'une prise en charge préalable en structure spécialisée de la douleur (centre antidouleur) ?
- Mécanisme du raisonnement neurochirurgical ?
- Valeurs des examens complémentaires ?
- Intérêt de l'évaluation neuropsychologique ?

# STIMULATION MEDULLAIRE

## Evaluations paracliniques

- **Imagerie** (démonstration lésion neurologiques # dysfonctionnement )
- **Thermotest** ( complète les données de l'examen clinique en quantifiant les seuils sensitifs)
- **EMG** (grosses fibres périphériques, valeur de localisation de la lésion)
- **PES** ( voie lemniscale non nociceptive, valeur de localisation de la lésion)
- **PEN** par laser ( fibre fines de la voie nociceptive établit le diagnostic)
- **L'imagerie** fonctionnelle (recherche clinique)

# STIMULATION MEDULLAIRE

## Tests pré chirurgicaux à valeur pronostique

- **Bloc nerveux** (si précis valeur localisatrice de la douleur et du niveau lésionnel pour les lésions périphériques mais pas des mécanisme)
- **Tests pharmacologiques** (valeur diagnostique, pas pronostique)
- **NSTC** (pour stim médullaire pas de valeur si négatif)

# STIMULATION MEDULLAIRE

## Modalités thérapeutiques à disposition

### Anatomique

Reconstitution anatomique au niveau périphérique (décompression, neurolyse, excision névrome, réparation-greffe...)



Canal lombaire étroit



Neurolyse



Névrome postchirurgical

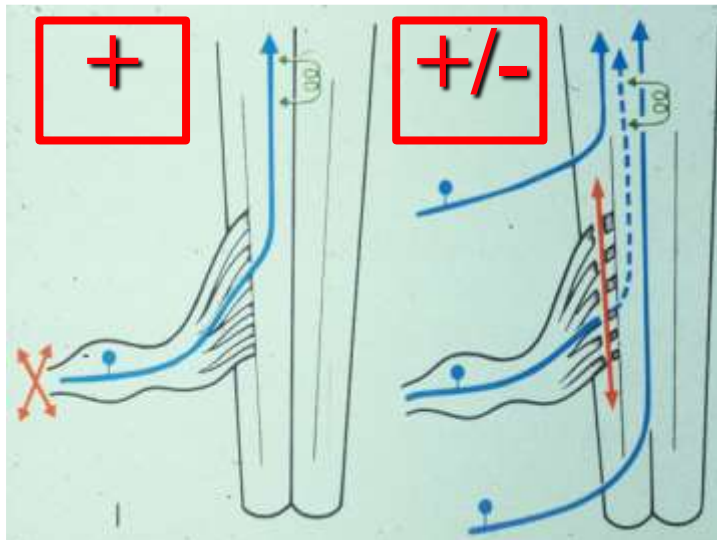
# STIMULATION MEDULLAIRE

- Selection of patients
  - ✓ neuropathic pain without any active disease
  - ✓ This treatment would at least have included anticonvulsants, tricyclic antidepressants
  - ✓ The psychosocial assessment is necessary

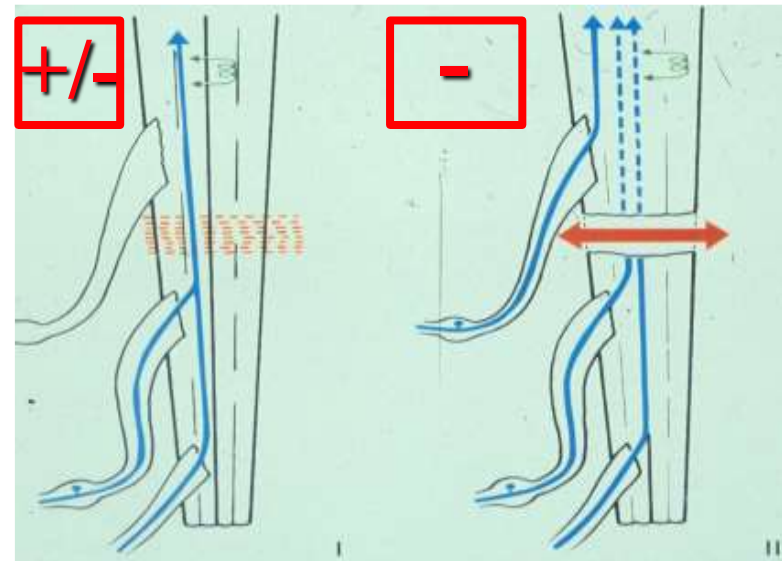
# STIMULATION MEDULLAIRE

- Selection of patients

- ✓ analysis of anatomical and physiological mechanisms of pain



**Distal/ganglion**    **Proximal/ganglion**  
**Peripheral lesion**



**Partial**    **Complete**  
**Spinal lesion**



# STIMULATION MEDULLAIRE

## INDICATIONS

Indication	Bonne	Modérée	Pauvre	Mauvaise
Radiculalgie réfractaire postchirurgicale	<b>X</b>			
Synd de douleur régionale complexe	<b>X</b>			
Angine de poitrine	<b>X</b>			
Douleur associée a une maladie vasculaire périphérique	<b>X</b>			
Douleur plexique brachiale traumatique, avulsive, radique		<b>X</b>	<b>X</b>	
Douleur de membre fantôme			<b>X</b>	<b>X</b>

# STIMULATION MEDULLAIRE

## INDICATIONS

Indication	Bonne	Modérée	Pauvre	Mauvaise
Douleur neuropathique intercostale postthoracotomie ou post-herpetique			X	
Douleur centrale médullaire			X	
Section médullaire complète				X
Douleur par excès de nociception non ischémique				X
Avulsion de racine nerveuse				X
Douleur perineale ou anorectale				X

# STIMULATION MEDULLAIRE

## CONTRE-INDICATIONS

- Coagulation
- Infection systémique ou locale
- Atteinte de l'état cognitif ou psychologique
- les patients aux prises avec un problème d'abus d'alcool, de médicaments ou de drogues.

# STIMULATION MEDULLAIRE

## CONCLUSION

- Douleur chronique et réfractaire
- Timing
- Sélection des patients
- Résultat corrèle avec la rigueur des indications

**MERCI DE VOTRE  
ATTENTION**