UNDERSTANDING SPINAL CORD INJURY

Refer to Chapter 1 in SCI Reference Manual

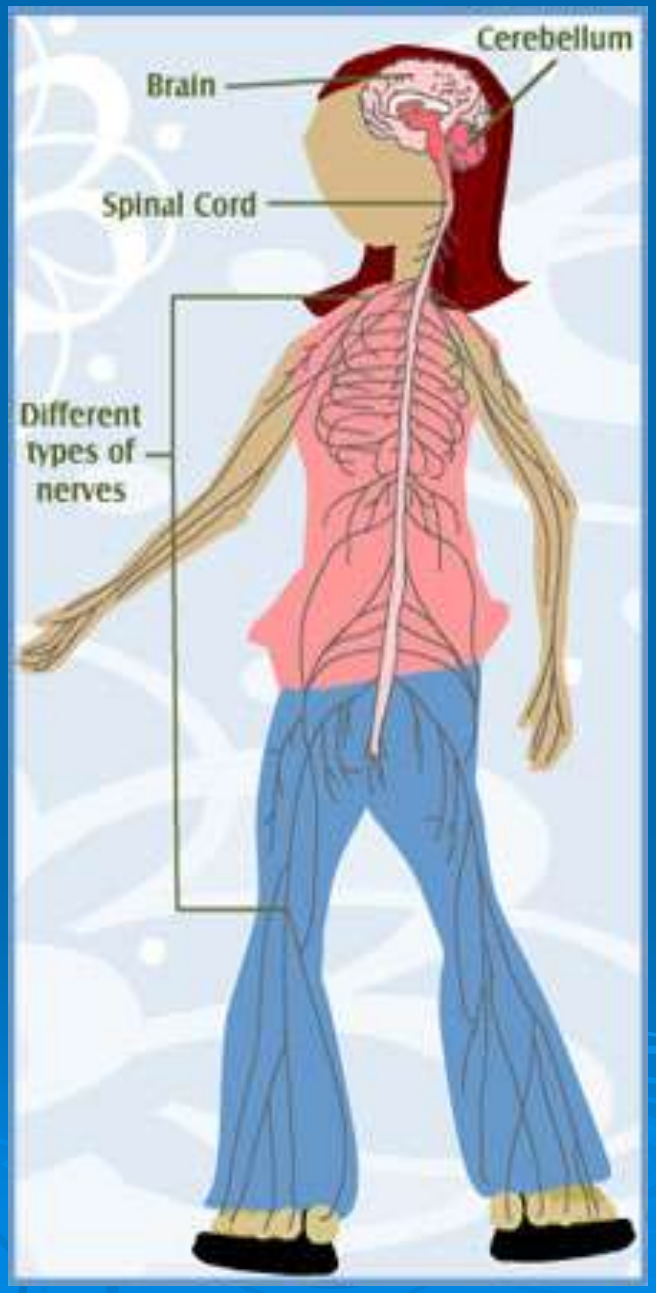
Three key messages

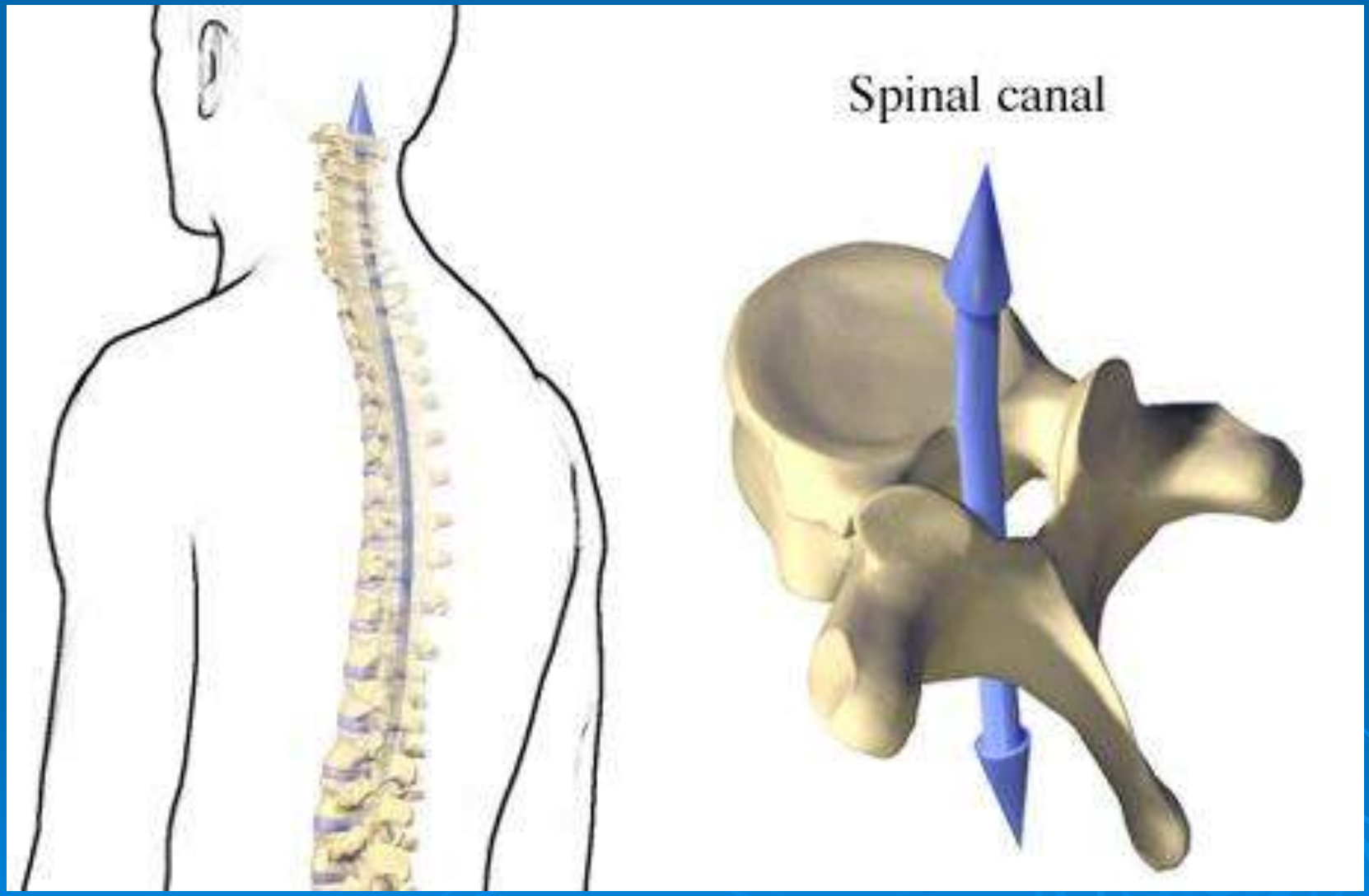
- The spinal cord is rarely severed
- Any of the nerves below the level of a spinal cord injury can be affected by a spinal cord injury
- Bowel, bladder and sexual function can be affected in every spinal cord injury

What is the spinal cord?

- The spinal cord is a soft fragile structure that is protected by the spine bones that surround it
- It is our body's communication system
- Signals run up and down through nerves in the spinal cord and allow the body and the brain to communicate

- Messages from the brain move down the spinal cord out to the body producing movement
- Messages from the body move up the spinal cord to the brain to provide sensation




Spinal canal

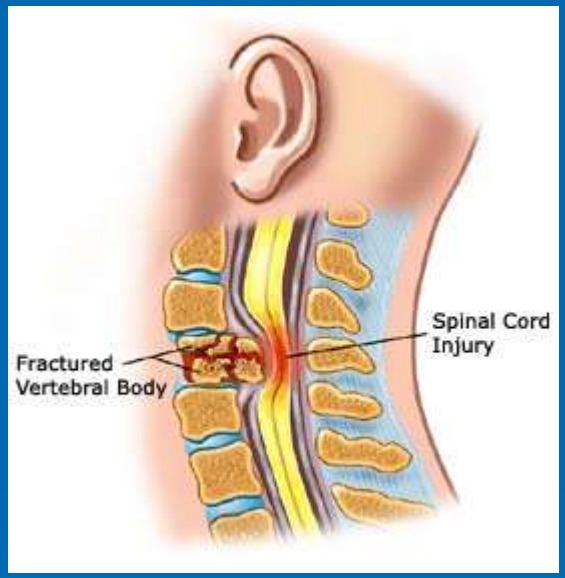
How is the spinal cord injured?

- Injuries can be traumatic or non-traumatic
  - Falls, motor vehicle crashes, sporting accidents
  - Infections, tumours, bleeds or strokes

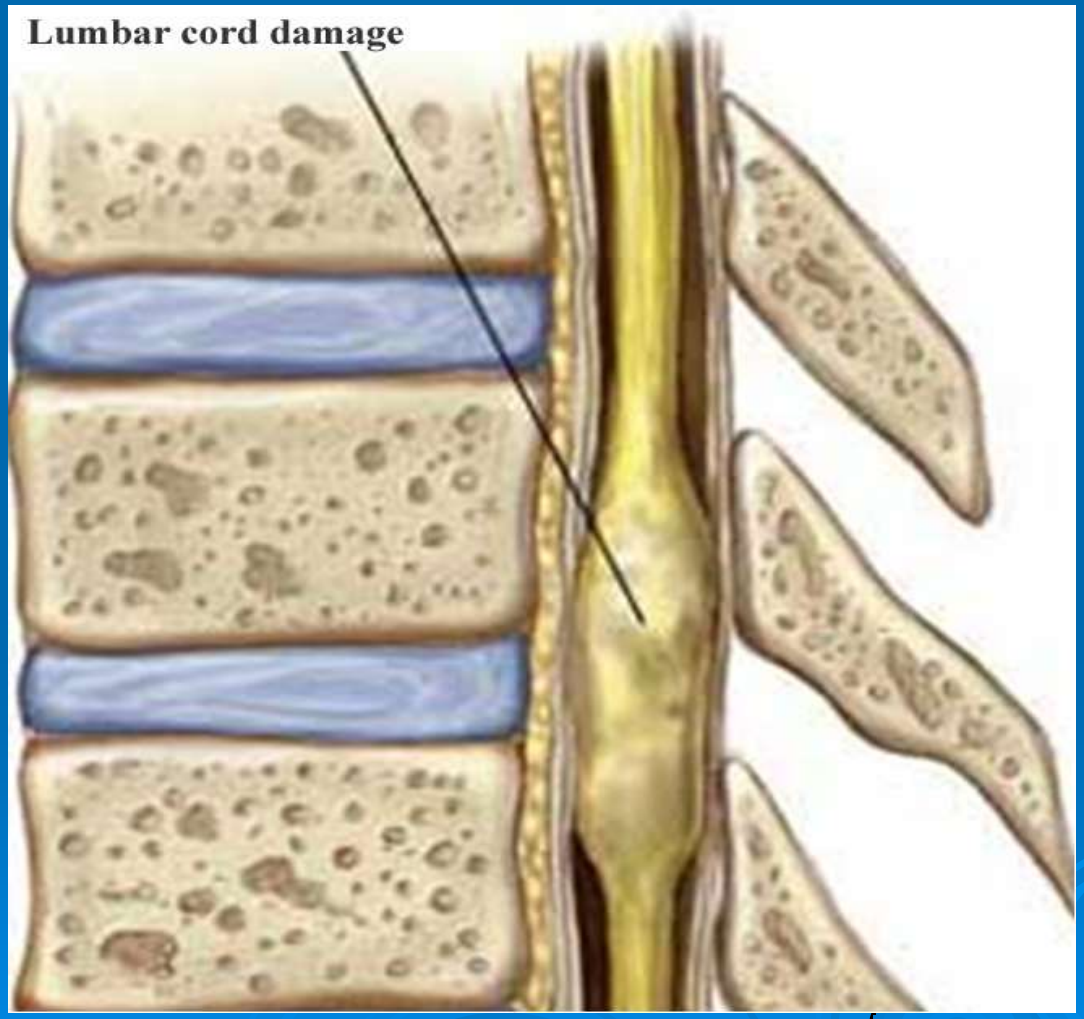
When the spinal cord is injured, the messages that run through the nerves in the spinal cord are interrupted.

- The spinal cord is RARELY severed – it may be compressed, stretched or squished

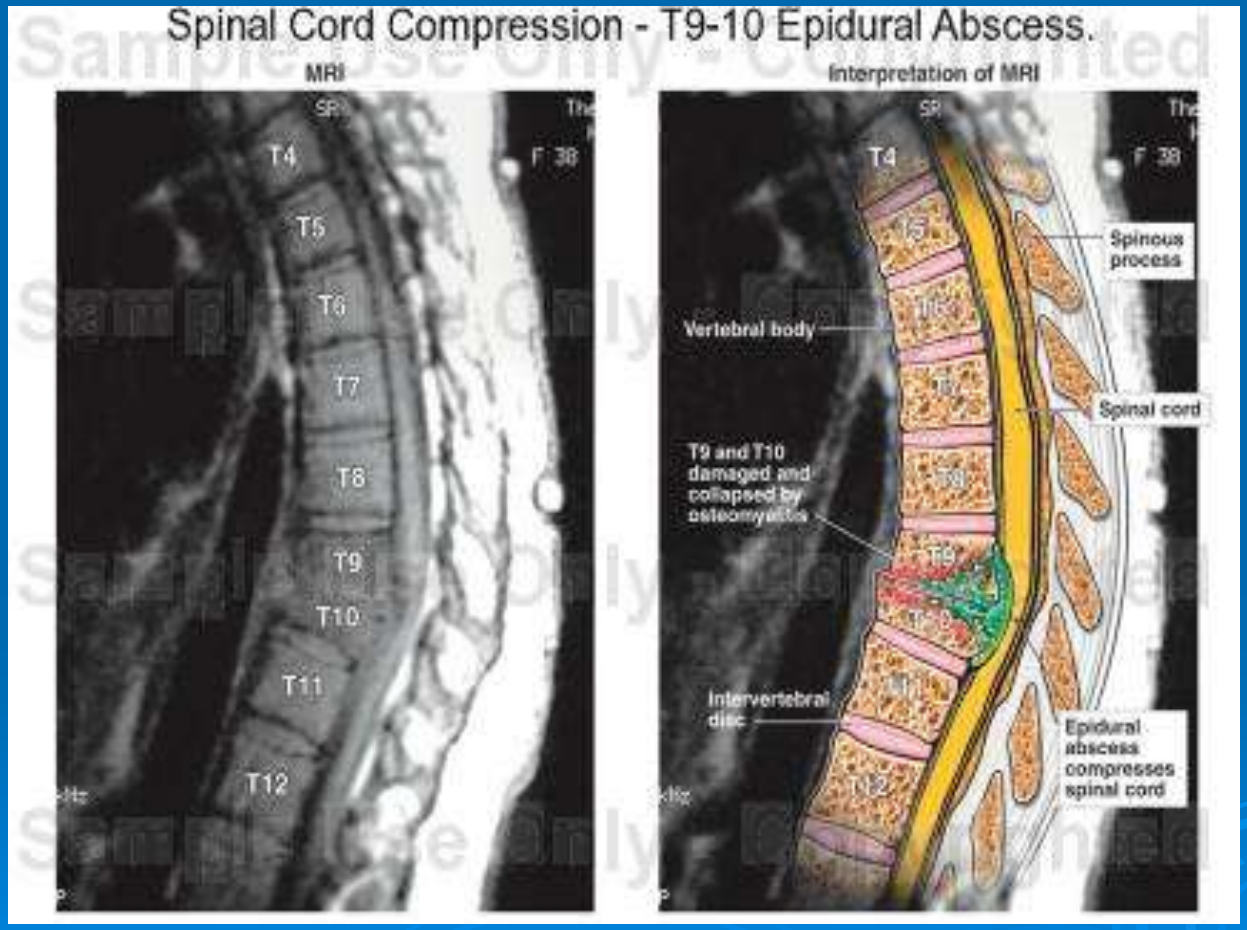
Traumatic Spinal Cord Injury



Non-traumatic Spinal Cord Injury



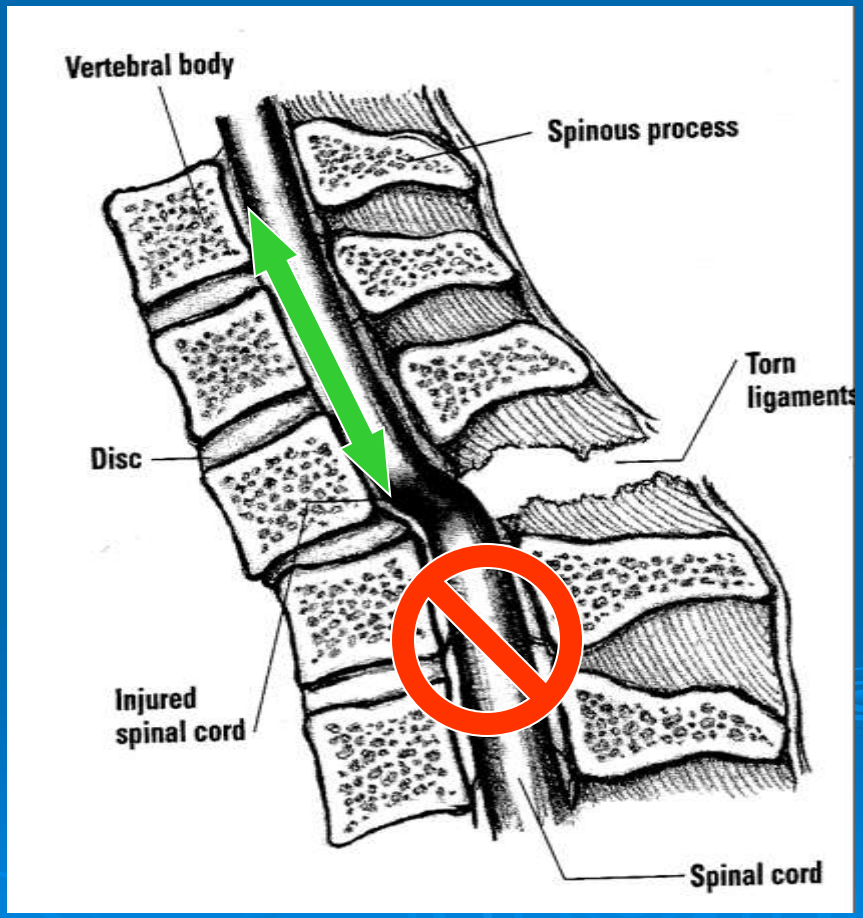
Non-traumatic SCI



What Happens after SCI?

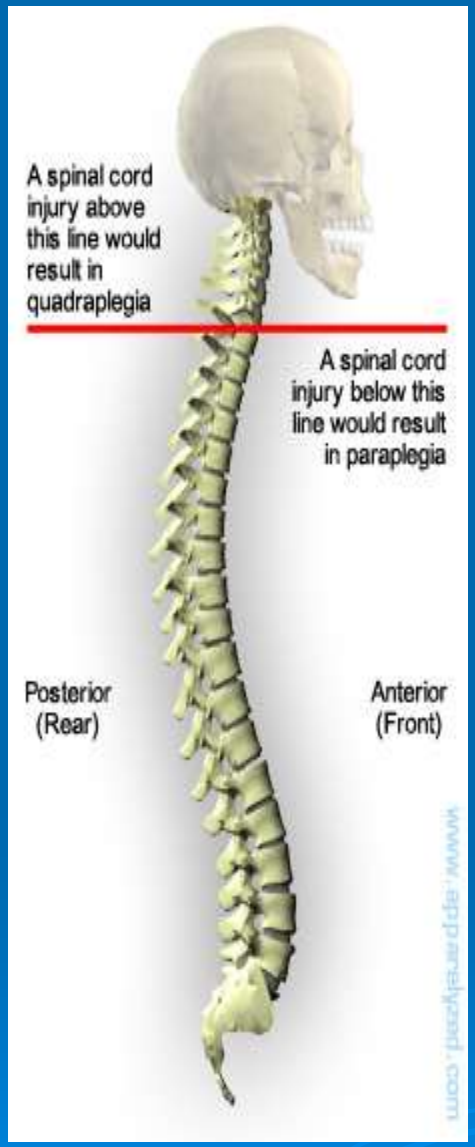
- After a SCI, information from the brain to the body and back is interrupted
- The signals cannot get through the spinal cord

- Any nerves above the injury (toward the head) will be intact
- Any nerves below the injury (toward the tail-bone) can be affected

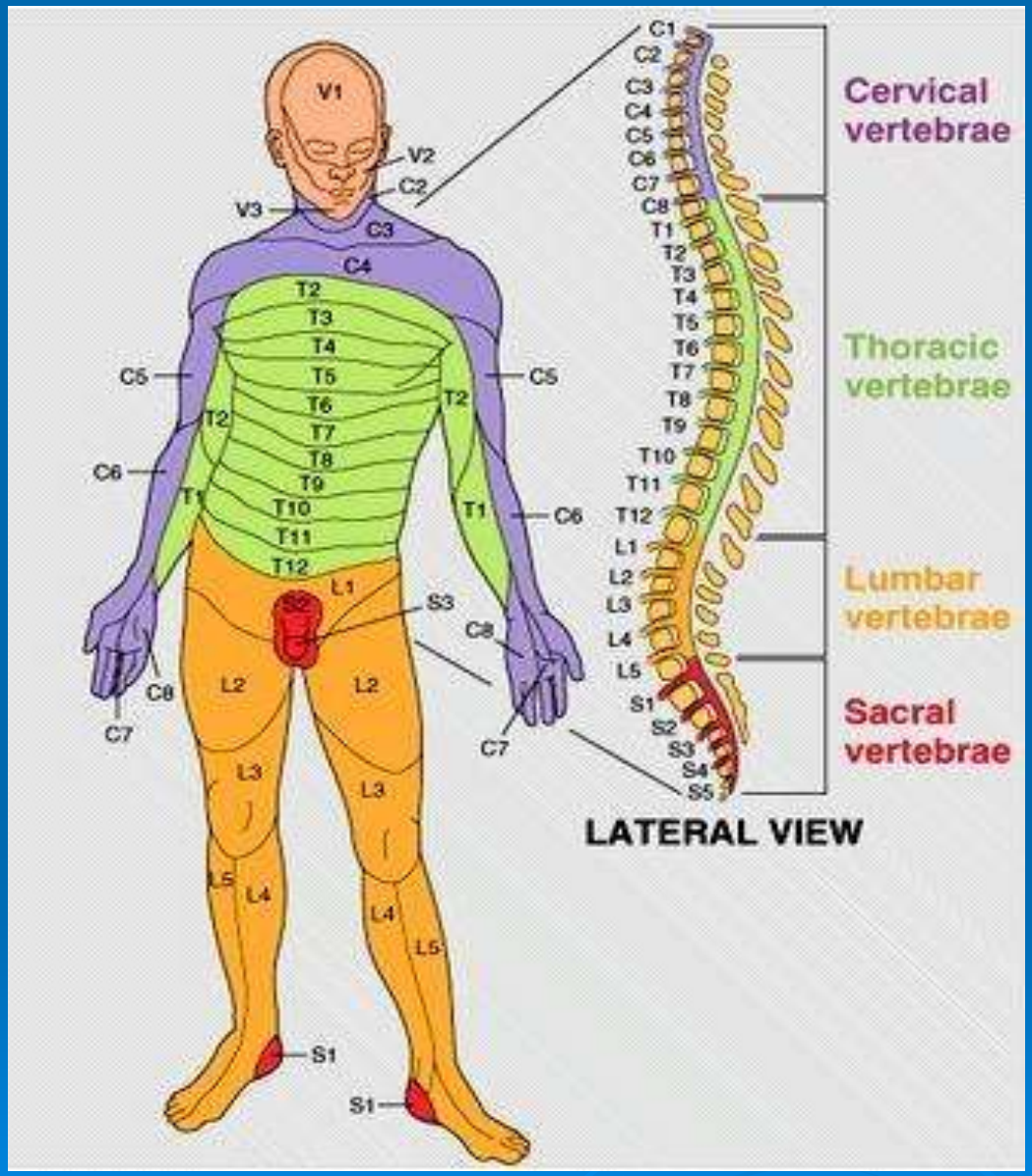


- When we talk about spinal cord injuries, we talk about two things
  - level of injury
  - completeness

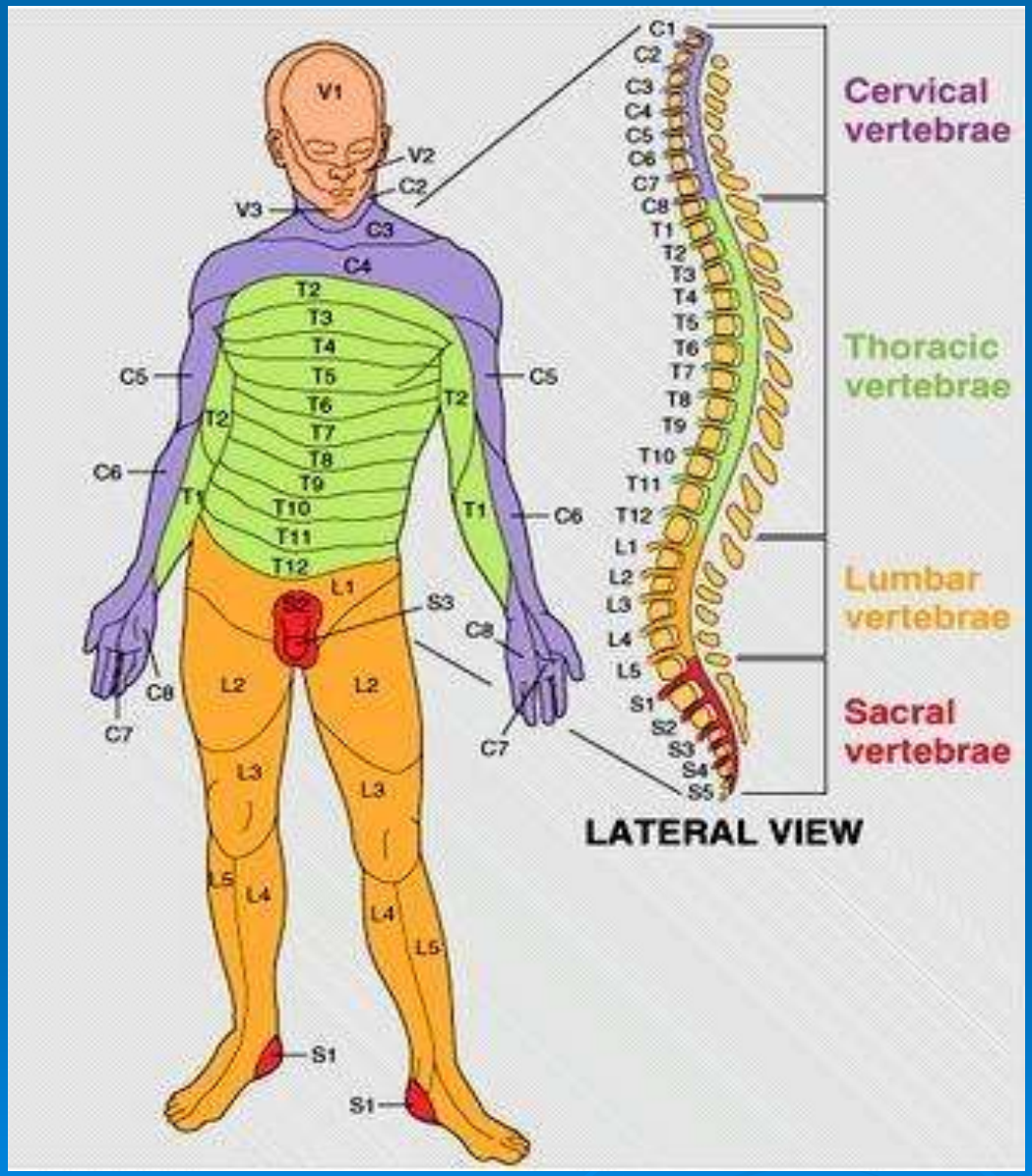
- The level of injury depends on which nerves have been affected
- We call that the neurological level
- Usually that is the same as the bony level of injury, but not always



- Quadriplegia is loss of some or all function of all 4 limbs (quadriplegia=tetra plegia)
- Paraplegia is loss of some or all function of legs



Any nerves below the level of the injury can be affected.



The last nerves exit the bottom of the spinal canal at the sacrum.

These nerves are responsible for bladder, bowel and sexual function.

The nerves at the very bottom of the spinal cord…

Are the nerves responsible for bladder, bowel and sexual function.

So the level of injury

- Tells us which parts of your body may have been affected by your spinal cord injury

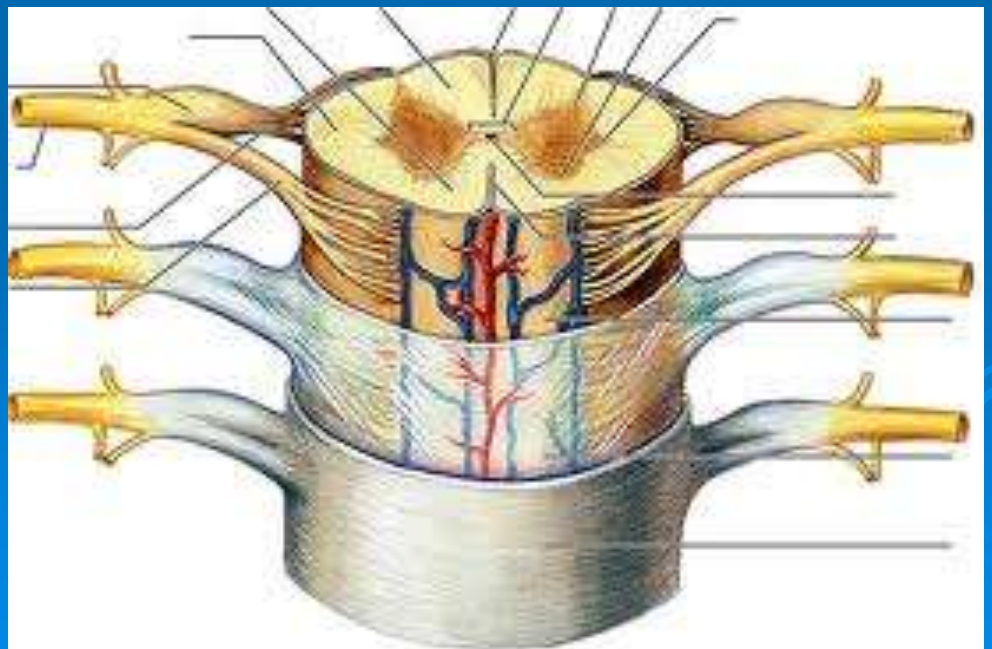
For any given level of injury…

- Any nerves below the level of the spinal cord injury can be affected
- But they might not be affected to the same extent in every patient
- So different patients with the same level of injury might have different signs and symptoms

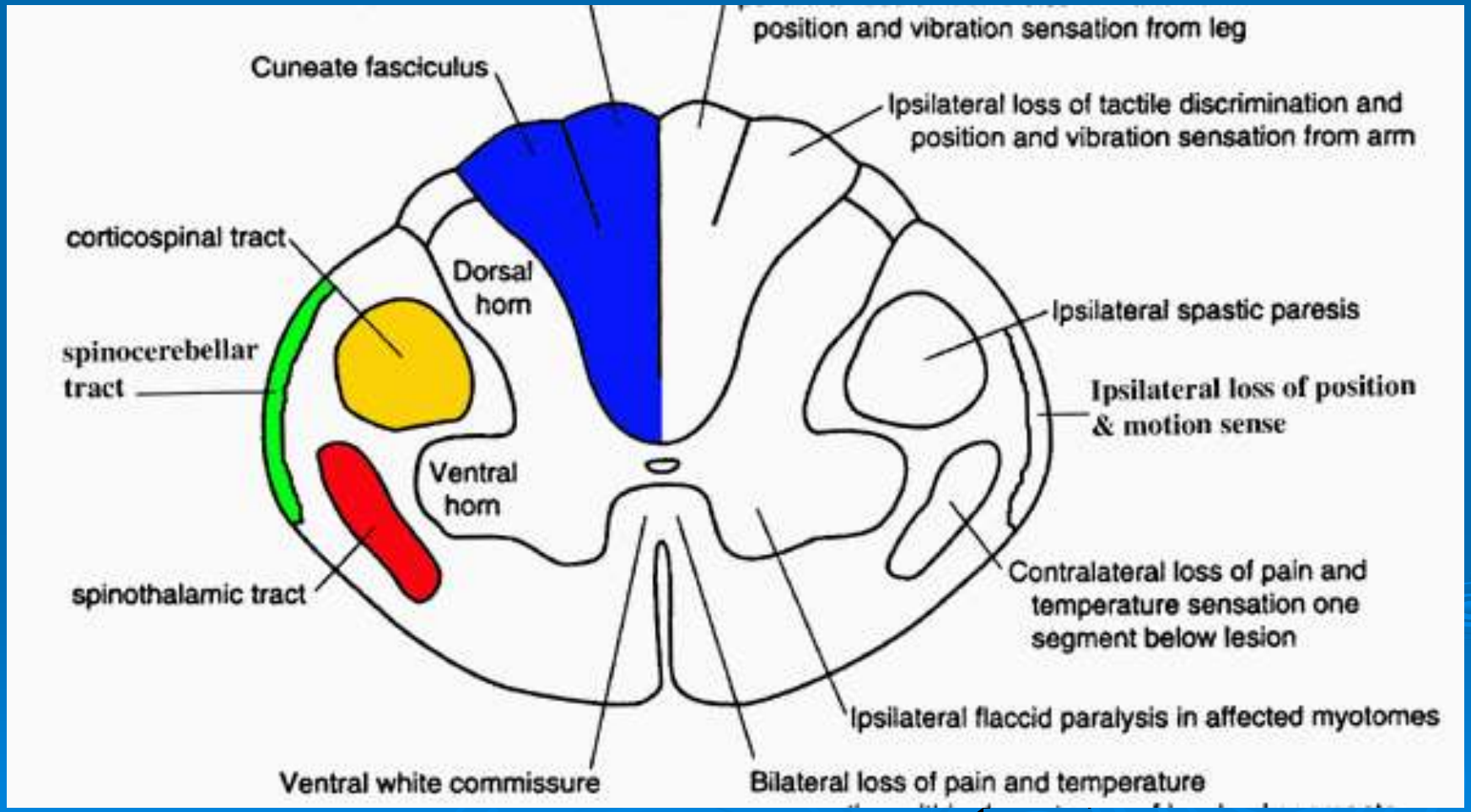
It depends mainly on…

The completeness of the injury:

The completeness of the injury depends on how much of the cross-section of the spinal cord injury has been affected



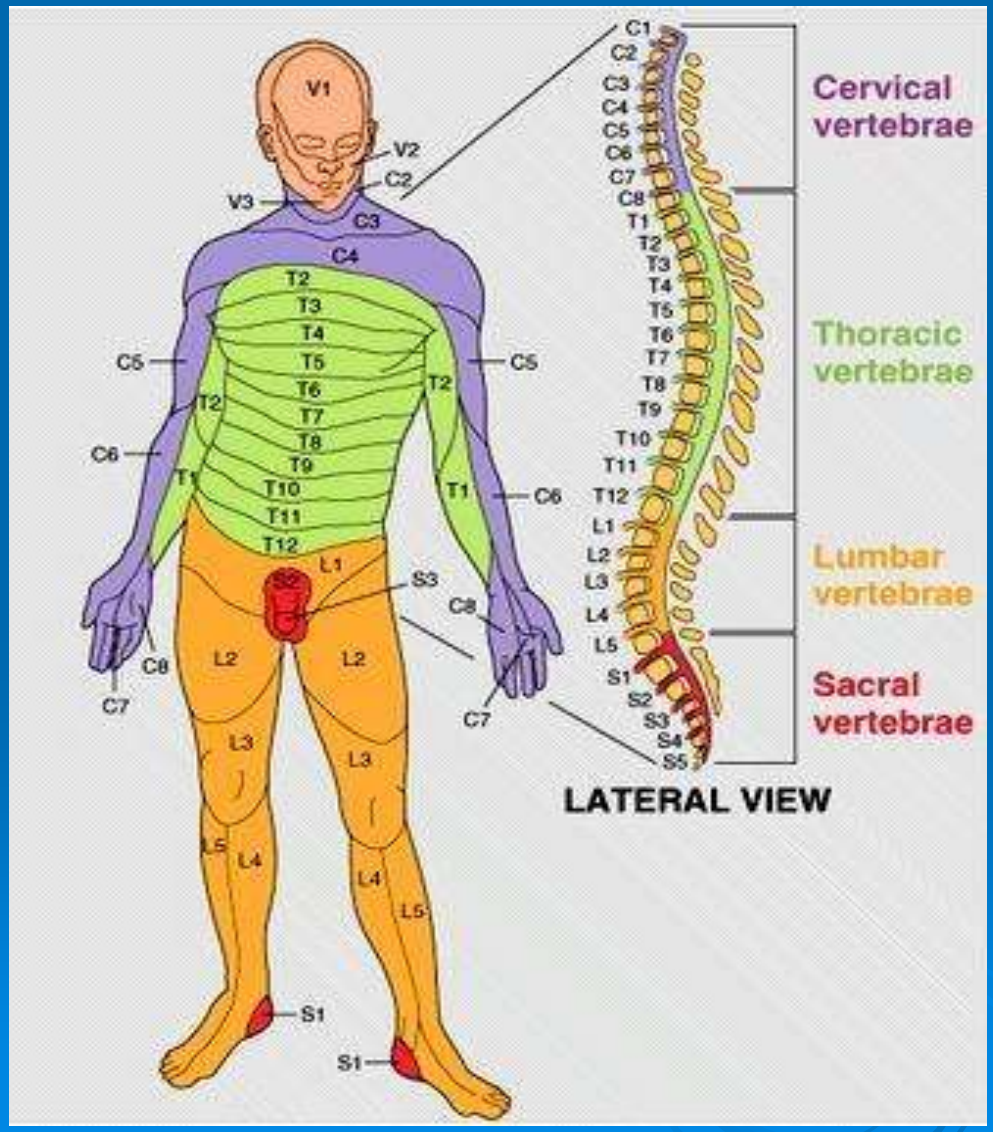
The spinal cord is like a multilaned highway



To help determine completeness, we check the different lanes of the highway

- Light touch
- Pinprick
- Strength and movement

How is “completeness” assessed?



By testing to see if there is any signal getting to or from the brain to the very bottom of the spinal cord.

Those are the nerves that are responsible for bladder, bowel and sexual function.

We test those by doing a digital rectal exam.

All spinal cord injuries have a different degree of "completeness"

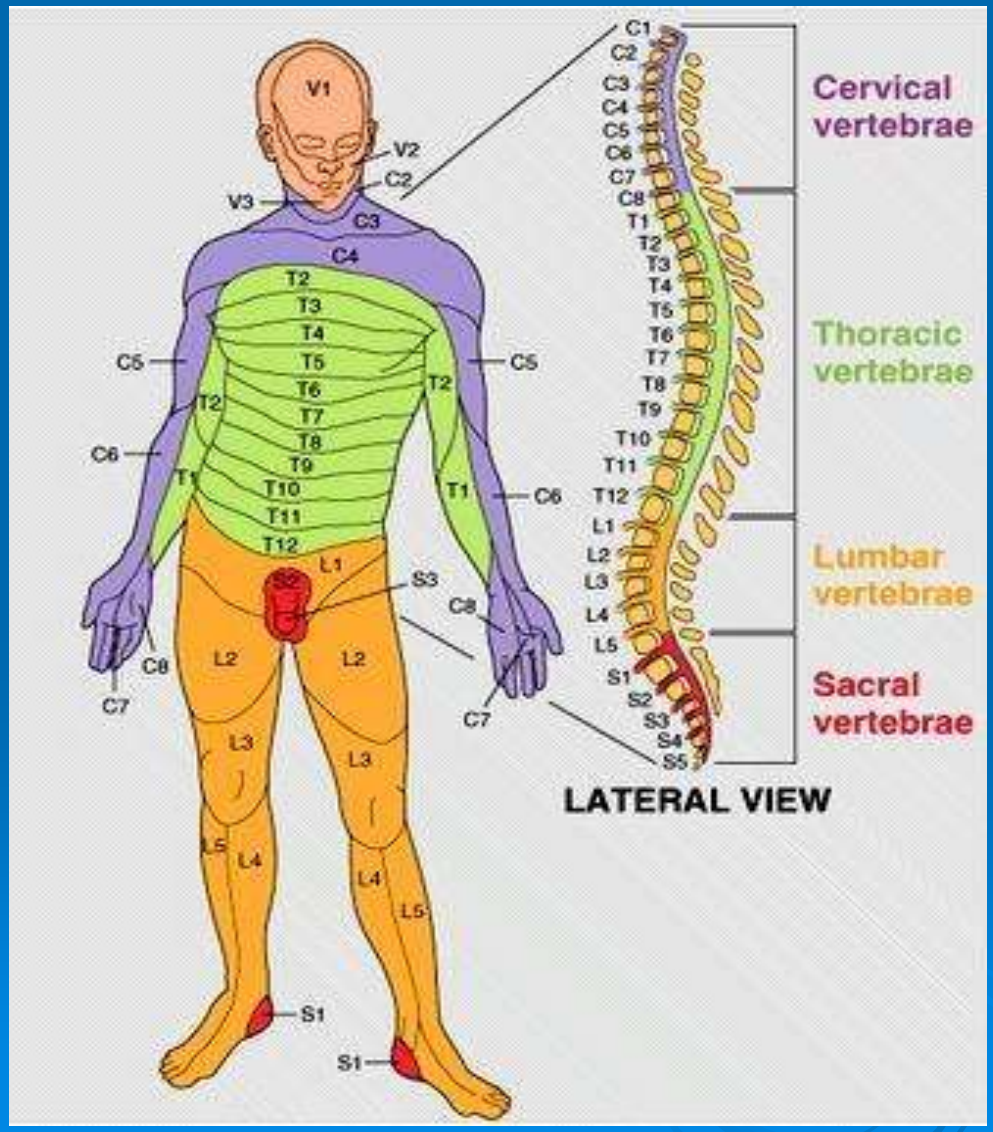
ASIA (American Spinal Injury Association) Impairment Scale

A = complete spinal cord injury

B, C, or D = incomplete spinal cord injury

E= no neurologic injury

How is “completeness” assessed?



If there is some signal getting through, then the injury is incomplete.

ASIA impairment scale B-D

If there is no signal to those nerves, the injury is complete.

ASIA impairment scale A

- Remember, the spinal cord is rarely severed.
- Any nerves below the injury can be affected by a spinal cord injury
- “Completeness” of a spinal cord injury depends on whether there is any signal getting all the way

- There are some things you can't change
  - Completeness and level of injury
  - Age
  - Other health problems

How can I take charge?

- Eat right
- Maintain a healthy body weight
- Get enough rest
- Learn as much as you can about your injury so that you can be your own best advocate
  - Take care of your skin
  - Learn about your medications
  - Learn about your bladder and bowel care
  - Attend your therapy and education sessions
- Don’t smoke and avoid alcohol and drugs

SCI Research

- Never Say…”Never”
- Hope for the future
- Vancouver has one of the foremost research centres and works with researchers throughout the world

ICORD International Collaboration of Repair Discoveries

45 principal investigators + 300 researchers

Hub of Rick Hansen SCI Network

10,000 m2 facility

http://www.icord.org

Where can you learn more about research?

- ICORD website www.icord.org

- **Experimental Treatments for Spinal Cord Injury: What you should know**

Three key messages

- The spinal cord is rarely severed
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- Bowel, bladder and sexual function can be affected in every spinal cord injury

Questions?

Why do people have surgery?

- Bony stabilization, fracture repair
- Recreation of the spinal canal
- Removal of bone fragments, blood collection or pus
- Surgery does not repair the underlying spinal cord damage!

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

MOTOR

KEY MUSCLES

	R	L	
C2			
C3			
C4			
C5			Elbow Flexors
C6			Wrist Extensors
C7			Elbow Extensors
C8			Finger Flexors (distal phalanx of middle finger)
T1			Finger Abductors (little finger)
T2			
T3			
T4			
T5			
T6			
T7			
T8			
T9			
T10			
T11			
T12			
L1			
L2			Hip Flexors
L3			Knee Extensors
L4			Ankle Dorsiflexors
L5			Long Toe Extensors
S1			Ankle Plantar Flexors
S2			
S3			
S4-5			

0 = total paralysis
1 = palpable or visible contraction
2 = active movement, gravity eliminated
3 = active movement, against gravity
4 = active movement, against some resistance
5 = active movement, against full resistance
NT = not testable

☐ Voluntary anal contraction (Yes/No)

TOTALS ☐ + ☐ = ☐ **MOTOR SCORE**

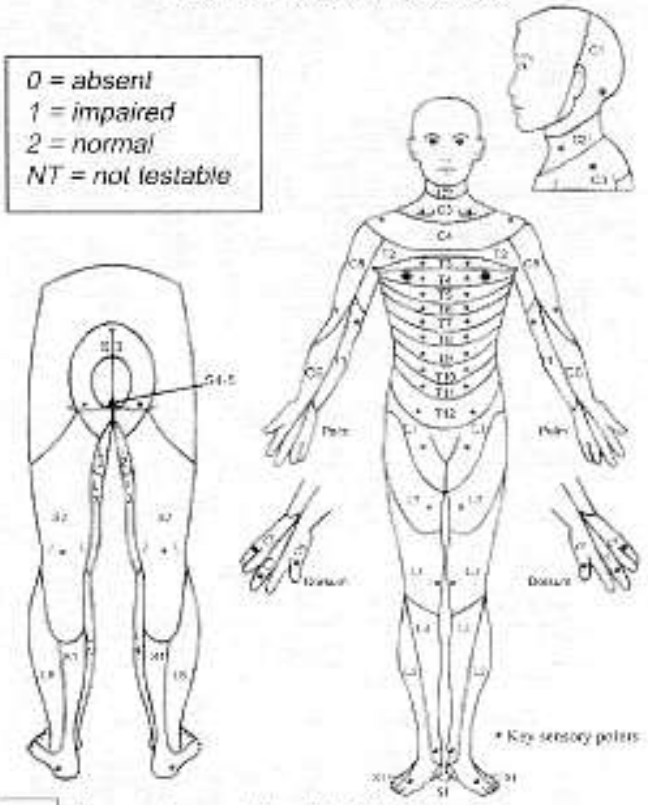
(MAXIMUM) (50) (50) (100)

SENSORY

KEY SENSORY POINTS

	LIGHT TOUCH R	LIGHT TOUCH L	PIN PRICK R	PIN PRICK L
C2				
C3				
C4				
C5				
C6				
C7				
C8				
T1				
T2				
T3				
T4				
T5				
T6				
T7				
T8				
T9				
T10				
T11				
T12				
L1				
L2				
L3				
L4				
L5				
S1				
S2				
S3				
S4-5				

0 = absent
1 = impaired
2 = normal
NT = not testable



☐ Any anal sensation (Yes/No)

☐ **PIN PRICK SCORE** (max: 112)

☐ **LIGHT TOUCH SCORE** (max: 112)

TOTALS ☐ + ☐ ☐ + ☐

(MAXIMUM) (56) (56) (56) (56)

NEUROLGICAL LEVEL
the most caudal segment with normal function

	R	L
SENSORY	☐	☐
MOTOR	☐	☐

COMPLETE OR INCOMPLETE ☐
Incomplete = Any sensory or motor function in S4-S5

ASIA IMPAIRMENT SCALE ☐

ZONE OF PARTIAL PRESERVATION
Partially innervated segments

	R	L
SENSORY	☐	☐
MOTOR	☐	☐

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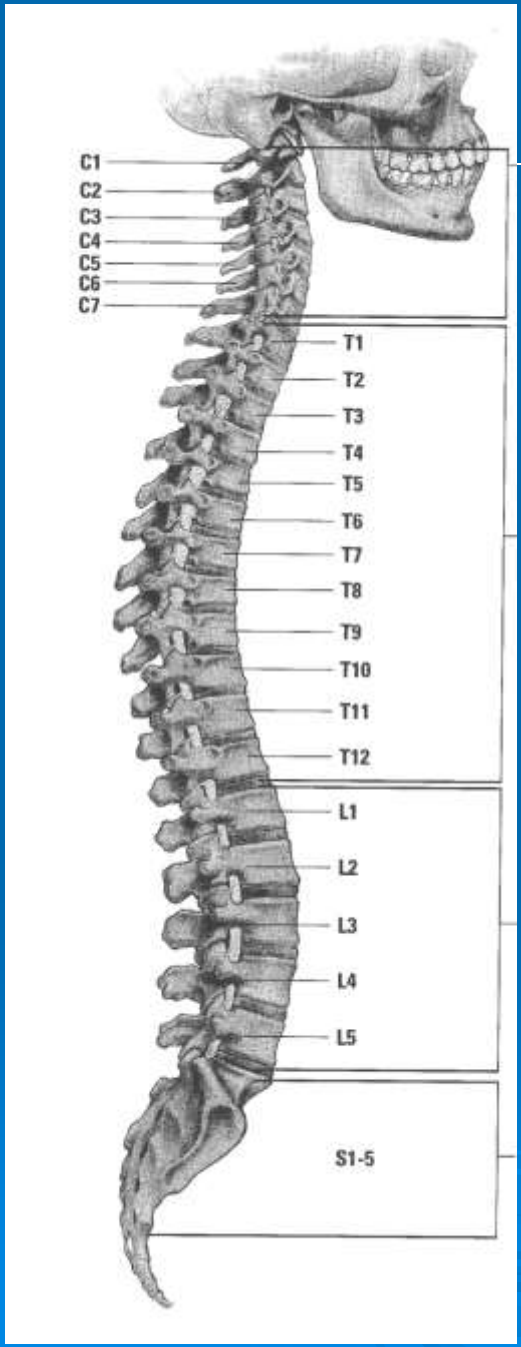
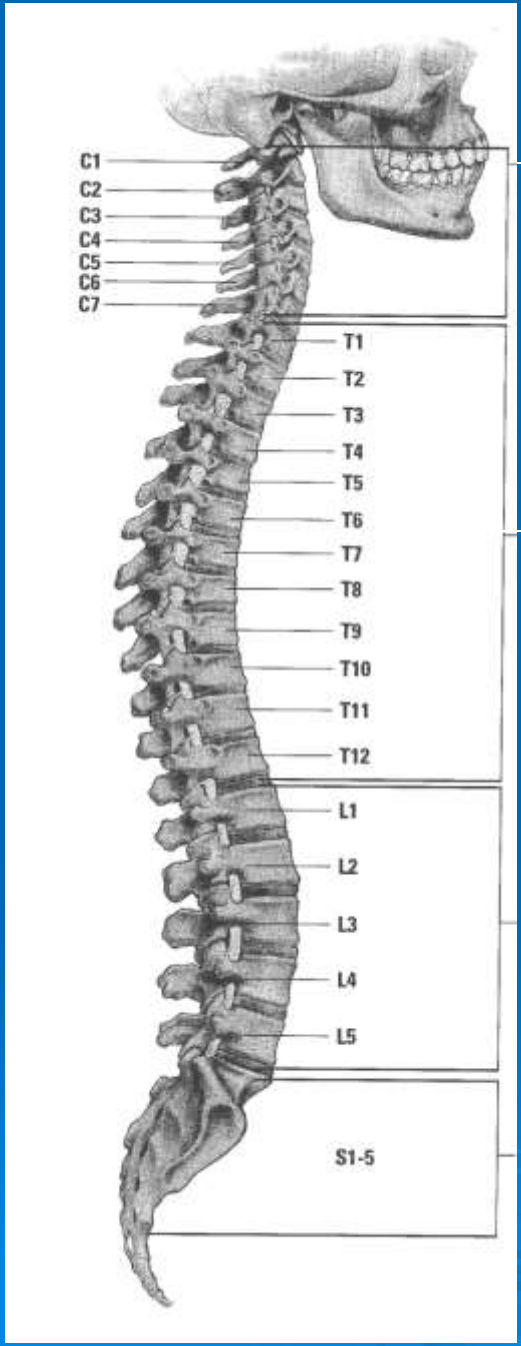


Cervical Segments

- C4: Diaphragm
- C5: Deltoid/Biceps
- C6: Wrist Extensors
- C7: Triceps
- C8: Hand muscles



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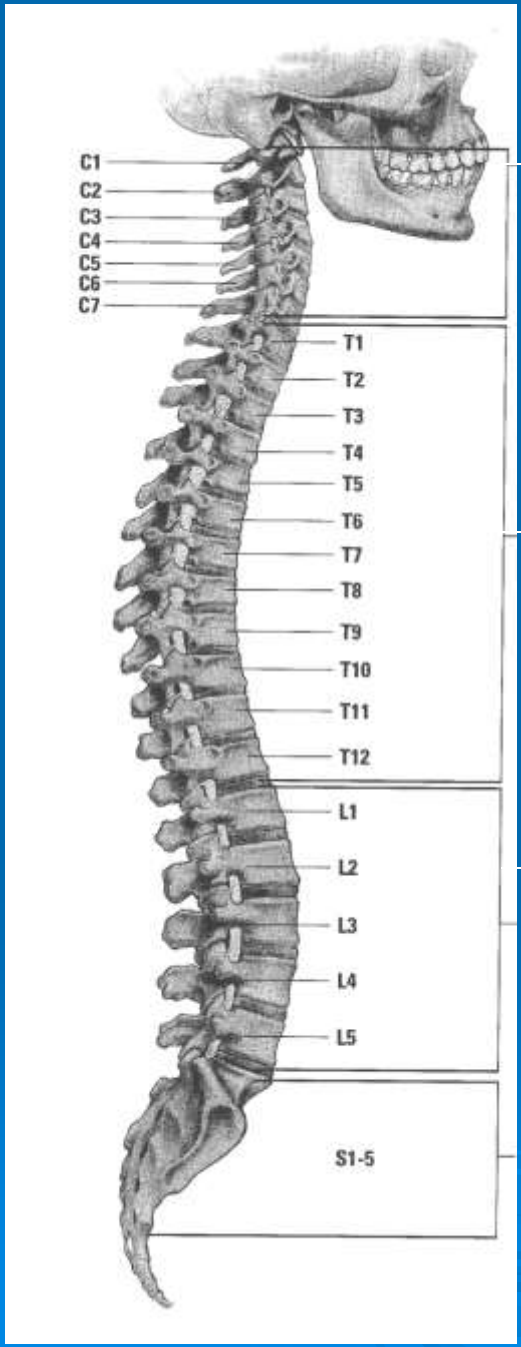
Thoracic Segments

- T2-T7: Chest Muscles
- T8-T12: Abdominals



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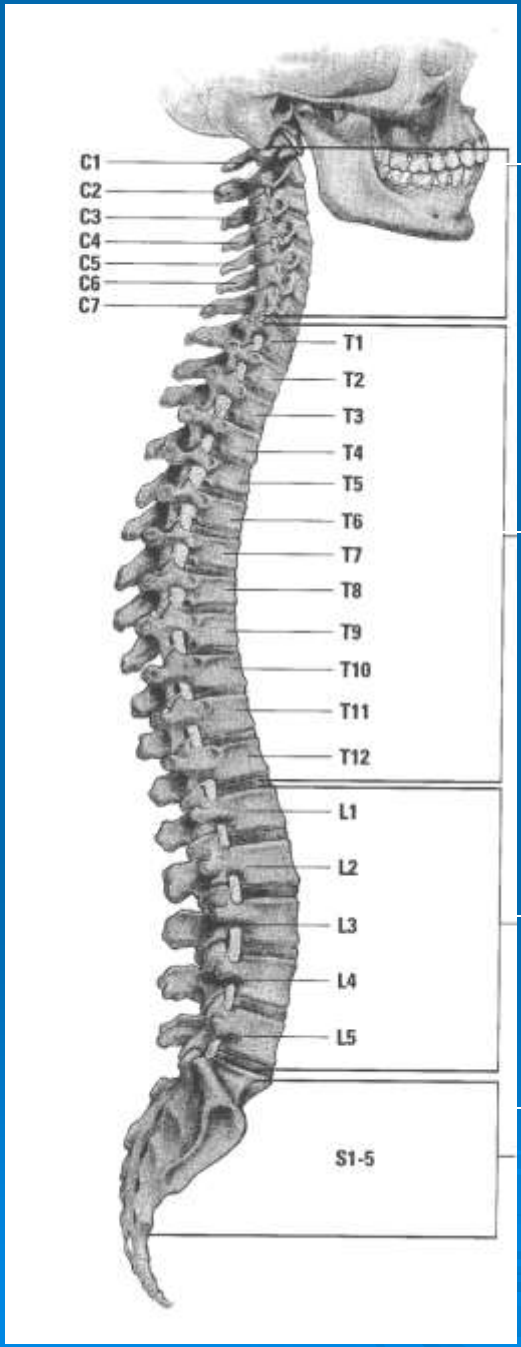
Lumbar Segments

- L1-L5: Leg Muscles



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Sacral Segments

- Bowel and Bladder Function
- Sexual Function