

行政院國家科學委員會專題研究計畫 成果報告

鼠脊髓損傷後施予或未施修復所造成的運動系統之神經重  
塑(2/2)

計畫類別：個別型計畫

計畫編號：NSC94-2320-B-040-009-

執行期間：94年08月01日至95年07月31日

執行單位：中山醫學大學醫學系解剖學科

計畫主持人：藍琴臺

共同主持人：鄭宏志

報告類型：完整報告

處理方式：本計畫可公開查詢

中 華 民 國 95 年 11 月 1 日

# **Supraspinal neuronal regeneration correlates functional recovery following spinal cord injury with full repair strategy in rats**

**Chyn Tair Lan<sup>1\*</sup>, Henrich Cheng<sup>2</sup>, Peng-Wei Hsu<sup>3#</sup>, Jee-Ching Hsu<sup>4</sup>**

<sup>1</sup>Department of Anatomy, Faculty of Medicine, Chung-Shan Medical University, Taichung, Taiwan

<sup>2</sup>Center for Neural Regeneration, Department of Neurosurgery, Neurological Institute, Taipei Veterans General Hospital, Taipei, Taiwan

<sup>3</sup>Department of Neurosurgery, Chang-Gung Memorial Hospital, Taipei, Taiwan

<sup>4</sup>Department of Anesthesiology, Chang-Gung Memorial Hospital, Taipei, Taiwan

## **ABSTRACT**

Regeneration of supraspinal neurons of normal rats as well as the spinal cord injured (SCI) rats (spinal transection at T8-T9 and removal a 5-mm segment) with or without treatment by Dr. Cheng's repair strategy was studied by means of retrograde labeling of horseradish peroxidase (HRP) injected into the lumbosacral segments. The principal observations included that: 1) in the normal rats, the HRP-labeled neurons were distributed in the brainstem reticular nuclei, vestibular nuclei, locus coeruleus, midbrain laterodorsal and pedunculopontine tegmental nuclei, Kölliker-Fuse nucleus, nucleus K, red nucleus, thalamic paraventricular and ventromedial nuclei, lateral hypothalamic area, hypothalamic paraventricular nuclei, retrochiasmatic area and hindlimb area of cortex; 2) in the SCI rats with repair, there was a marked decrease of 70-90% in the number of regenerated neurons in the above-mentioned nuclei; and 3) HRP-labeled neurons were not detected in the SCI rats without repair. The possible neuroanatomical significance of the findings is discussed in the light of some functional restorations during the process of nerve regeneration.

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<sup>1</sup>Department of Anatomy, Faculty of Medicine, Chung-Shan Medical University

<sup>2</sup>Center for Neural Regeneration, Department of Neurosurgery, Neurological Institute, Taipei Veterans General Hospital

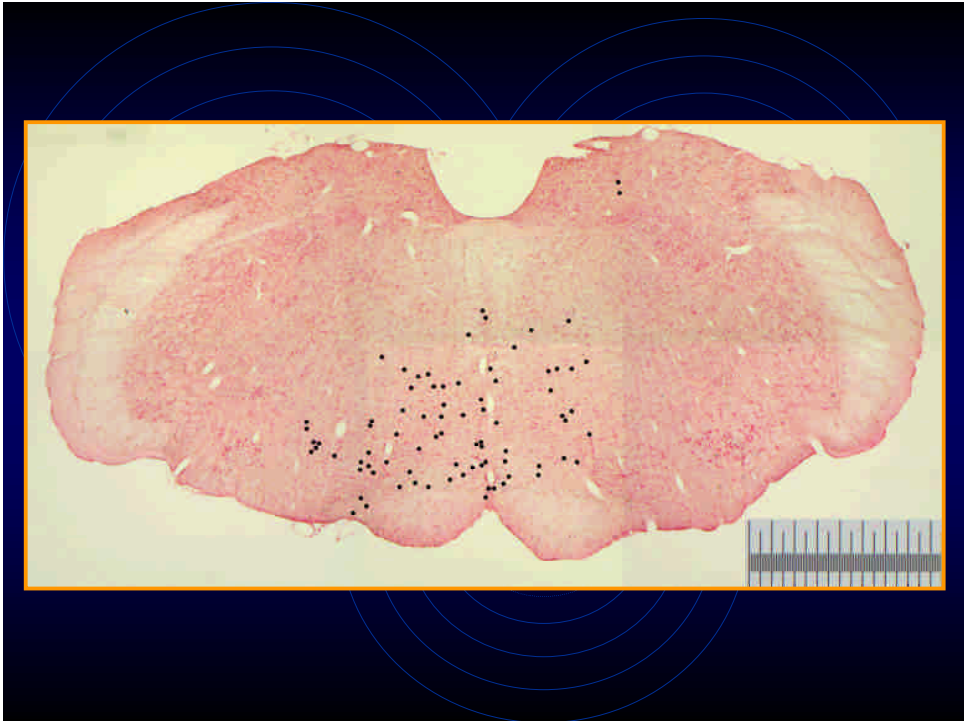
<sup>3</sup>Department of Neurosurgery, Chang-Gung Memorial Hospital

<sup>4</sup>Department of Anesthesiology, Chang-Gung Memorial Hospital

**HRP-labeled supraspinal neurons in the medulla of the control Animal**



**HRP-labeled supraspinal neurons in the medulla of the SCI Animal**



### Percent decrease of HRP-labeled neurons in the SCI-repaired group compared with the control

Raphe nuclei (ROb, RPa, RMg)	51.8 %
Medullary gigantocellular reticular nuclei (Gi, GiV, GiA)	70.3 %
Paragigantocellular nuclei (LPGi, DPGi)	64.0 %
Pontine gigantocellular reticular nuclei (PnV, PnC, PnO)	62.2 %
Vestibular nuclei (MVe, SpVe, LVe, SuVe)	51.2 %
Locus coeruleus complex (LC, SubCD, SubCV, SubCA)	75.3 %
Red nucleus, magnocellular (RMC)	60.0 %
Hind limb area of cortex (HL)	72.7 %
Lateral hypothalamic area (LH)	98.3 %
Paraventricular hypothalamic nucleus (Pa)	97.3 %

### Basso, Beattie, Bresnahan Locomotor Rating Scale (BBB) -- Early Stage of Recovery

0	No observable hindlimb (HL) movement
1	Slight movement of one or two joints, usually the hip &/or knee
2	Extensive movement of one-joint or extensive movement of one joint and slight movement of one other joint
3	Extensive movement of two joints
4	Slight movement of all three joints of the IM (hip, knee & ankle)
5	Slight movement of two joints and extensive movement of the third
6	Extensive movement of two joints and slight movement of the third
7	Extensive movement of all three joints of the forelimb (FL)

## Basso, Beattie, Bresnahan Locomotor Rating Scale (BBB) -- Intermediate Stage of Recovery

<b>8</b>	Sweeping with no weight support or plantar placement of the paw with no weight support
<b>9</b>	Plantar placement of the paw with weight support in stance only (i.e. when stationary) or occasional, frequent or consistent weight supported dorsal stepping and no plantar stepping
<b>10</b>	Occasional weight supported plantar steps, no FL-HL coordination
<b>11</b>	Frequent to consistent weight supported plantar steps and no FL-HL coordination
<b>12</b>	Frequent to consistent weight supported plantar steps and occasional FL-HL coordination
<b>13</b>	Consistent weight supported plantar steps and frequent FL-HL coordination

## Correlation of Anatomical Data and Functional Recovery

Rat No.	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m	9 m	Rat No.	dpo (m)	HRP
4065										R14	2.6	+
4057										R15	2.7	+
4116	3	4.5	2	1.5	6.25					R16	5.7	+++ ++
4074			6	1.25						R17	5.9	++
4176	3.5	4.5	1.5	1	3.25					R18	5.6	
4170	1.5	6.5	1.75	3.5	2	2.5	1	3		R19	11.2	++
4199	4.5	2.75	2.75	3.5	4	1.75	0.5	5	6.75	R20	11	+++ ++
4243	6.5	5.5	4.75	5	4.25	4.5	3.25	2.5	6.5	R21	10.5	+++ +