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Data in Brief

Transcriptional changes in sensory ganglia associated with primary afferent axon collateral sprouting in spared dermatome model

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ABSTRACT

Primary afferent collateral sprouting is a process whereby non-injured primary afferent neurons respond to some stimulus and extend new branches from existing axons. Neurons of both the central and peripheral nervous systems undergo this process, which contributes to both adaptive and maladaptive plasticity (e.g., [1–9]). In the model used here (the "spared dermatome" model), the intact sensory neurons respond to the denervation of adjacent areas of skin by sprouting new axon branches into that adjacent denervated territory. Investigations of gene expression changes associated with collateral sprouting can provide a better understanding of the molecular mechanisms controlling this process. Consequently, it can be used to develop treatments to promote functional recovery for spinal cord injury and other similar conditions. This report includes raw gene expression data files from microarray experiments in order to study the gene regulation in spared sensory ganglia in the initiation (7 days) and maintenance (14 days) phases of the spared dermatome model relative to intact ("naïve") sensory ganglia. Data has been deposited into GEO (GSE72551).

Specifications	
Organism/cell line/tissue	*Rattus norvegicus*
Sex	*Female*
Sequencer or array type	*Affymetrix GeneChip microarray Rattus norvegicus 230_2*
Data format	*Raw; CEL files*
Experimental factors	*T11 spared DRG, day 7 post injury vs. naïve; T11 spared DRG, day 14 post injury vs. naïve*
Experimental features	*Gene expression profiling of the T11 spared dermatome using naïve rats ($n = 5$), T11 spared DRG at day 7 post denervation of neighboring dermatomes ($n = 7$), and T11 spared DRG at day 14 post denervation of neighboring dermatomes ($n = 7$)*
Consent	*Not applicable*
Sample source location	*Not applicable*

Value of the data

- Transcriptomic analysis of this axon growth process is novel and could reveal mechanisms of axon growth.

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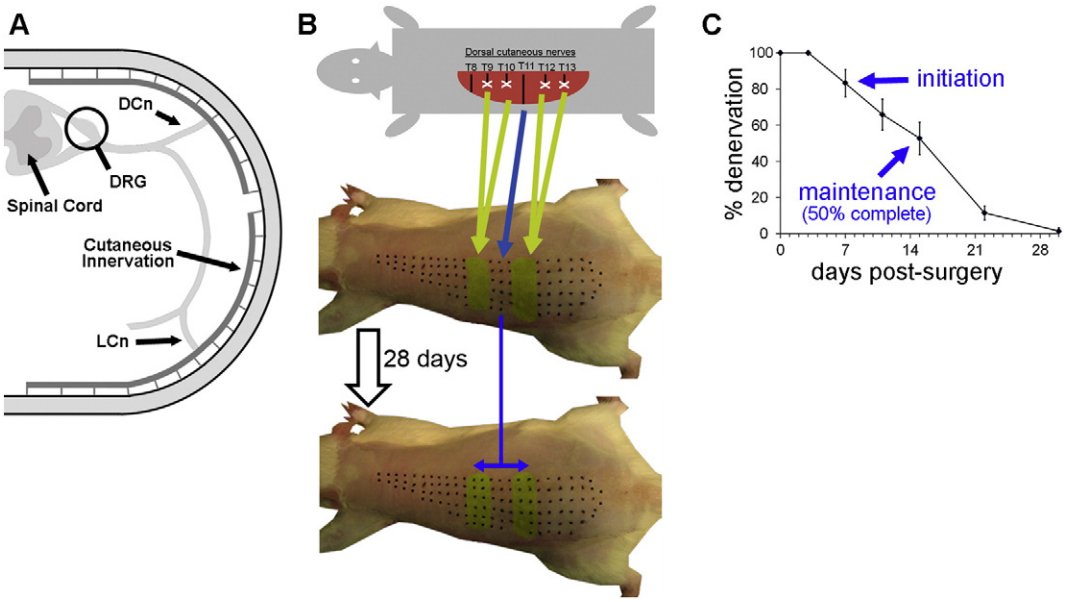

Fig. 1. Experimental Design. A) Schematic of the cross-sectional neuroanatomy of the thoracic region of the rat. The DRG is the structure in which the cell bodies of spinal sensory neurons are housed and which was used for microarray. Continuous with the DRG are the structures carrying the axon-branches of the sensory neurons: the dorsal root carrying axons into the spinal cord, and the spinal nerve (or nerve root in human clinical terms) carrying axons out to their peripheral target tissues. B) (Top) Schematic representation of the surgical preparation for the spared dermatome model, showing dorsal cutaneous nerve only (T = thoracic). (Middle, bottom) Mockup representation of the denervated and spared dermatomes, and the expansion of the spared T11 dermatome into the denervated dermatomes by collateral sprouting of the T11 sensory neurons. Black dots represent sensitive (i.e., innervated) areas of skin as defined by activation of the CTM reflex and the yellow/green shaded areas represent areas of denervation induced by axotomy of the T9, T10, T12 and T13 Dorsal and Lateral Cutaneous nerves which become re-innervated by expansion of spared T11 axons by 28 days. C) Graph of the reduction over time in the denervated area of skin (i.e., successful reinnervation by collateral sprouting). n = 6; error bars are SD.

- Axonal collateral sprouting, modeled here using peripheral nervous system, plays a role in both adaptive and maladaptive neural plasticity in CNS and PNS.
- Model provides samples enriched for neurons undergoing collateral sprouting, and impoverished for injured neurons.
- Provides transcriptomic profile against which other profiles can be compared to determine shared/different mechanisms.

1. Direct link to deposited data

Data is available through the Gene Expression Omnibus (GEO) [10] through the direct link http://www.ncbi.nlm.nih.gov/geo/query/acc.cgi?acc=GSE72551

2. Experimental design, materials and methods

2.1. Experimental design

All surgical procedures were performed in accordance with published NIH Guidelines and the Institutional Animal Care and Use Committee (IACUC) of Stony Brook University and the University of Louisville (sites where animal work was performed). In this study, we sought to identify gene expression changes associated with collateral sprouting. The experiments were designed to discover global gene expression changes in non-injured DRG neurons undergoing collateral sprouting. Collateral sprouting was induced using the "spared dermatome" model [dermatome is the neuroanatomical term for the area of skin innervated by a single spinal segment]. The focus of the study was the left-side dorsal root ganglion (DRG) of the 11th Thoracic spinal segment (T11). Adult female Sprague–Dawley rats (260–310 g) were anesthetized with pentobarbital (65 mg/kg, i.p.). Left-side T11 DRG neurons remained intact and underwent collateral sprouting after the left-side Dorsal and Lateral cutaneous nerves (DCn and LCn) of the adjacent segments (T9, T10, T12, and T13) were cut and ligated (to prevent regeneration) (Fig. 1A). Thus, the T9, T10, T12, and T13 dermatomes were denervated, but the T11 dermatome remained intact. Axons of the T11 dermatome (and thus derived from the T11 DRG), extended new branches to innervate the T9, T10, T12, and T13 dermatomes (Fig. 1B). [N.B.: This is NOT a spared root experiment. ALL spinal roots were non-injured. Peripheral nerves were used.] The acute denervation was confirmed using the cutaneous trunci muscle reflex (CTMR) in response to pinch [11–13]. The CTMR could be evoked from innervated areas but not from areas whose innervation had been cut. Thus, the border between innervated (i.e., T11 dermatome) and denervated (i.e., T9, 10, 12, 13 dermatomes) could be defined. Control for a negative CTMR response due to anesthesia levels was the presence of CTMR to pinch of non-denervated skin (T11 dermatome or contralateral side). When cutaneous axons expanded into denervated skin by collateral sprouting, so did the area of skin from which a CTM reflex could be evoked by pinch. Collateral sprouting-mediated expansion of the innervation over time was monitored using

Table 1
Concentration and purity data for samples loaded onto microarrays.

Sample ID	Time point	ng/ul	260/280	GEO ID
AJP	Naive	27	2.13	GSM1865032
AKG	Naive	58	2.02	GSM1865033
AJQ	Naive	18	2.08	(Failed QC)
AKH	Naive	46	2.05	GSM1865034
AKI	Naive	48	2.08	GSM1865035
AKJ	Naive	43	2.10	GSM1865036
AJS	7 day	53	2.06	GSM1865037
AKB	7 day	38	2.01	GSM1865038
AJT	7 day	43	2.07	GSM1865039
AJV	7 day	36	2.08	GSM1865040
AJR	7 day	71	2.06	GSM1865041
AKA	7 day	34	2.06	GSM1865042
AJY	7 day	42	2.07	GSM1865043
AIZ	14 day	33	2.04	GSM1865044
AIY	14 day	48	2.05	GSM1865045
AJO	14 day	29	2.03	GSM1865046
AJN	14 day	51	2.07	GSM1865047
AIW	14 day	52	2.00	GSM1865048
AIX	14 day	48	1.99	GSM1865049
AIV	14 day	32	1.92	GSM1865050