

What's the point

How Modern Technological Advances Are Validating Acupuncture as a Viable Treatment Modality

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Division of
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Medicine



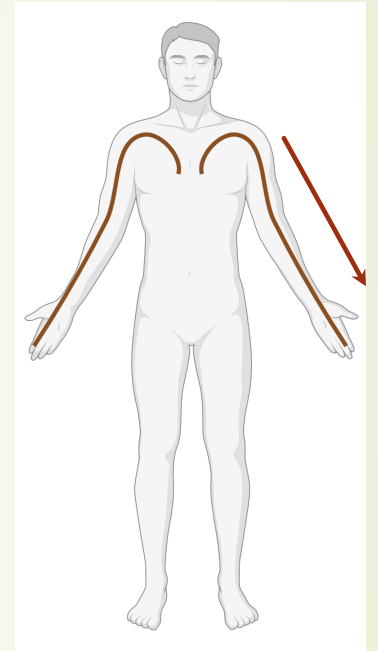
A brief history of acupuncture

- ▶ Early documentation of acupuncture: Yellow Emperor's Classic of Internal Medicine, Classic of Difficult Issues, & Systematic Classic of Acupuncture Moxibustion.
 - ▶ Meridians and acupoints were determined based on clinical experience and dissection; known from early days to follow nerves.
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Meridians and AP points

➤ 14 major meridians in the body

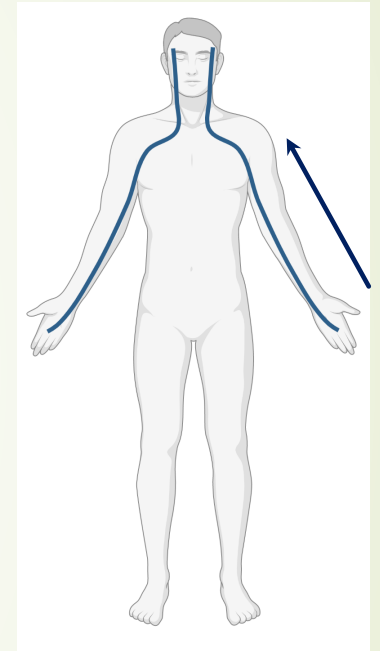
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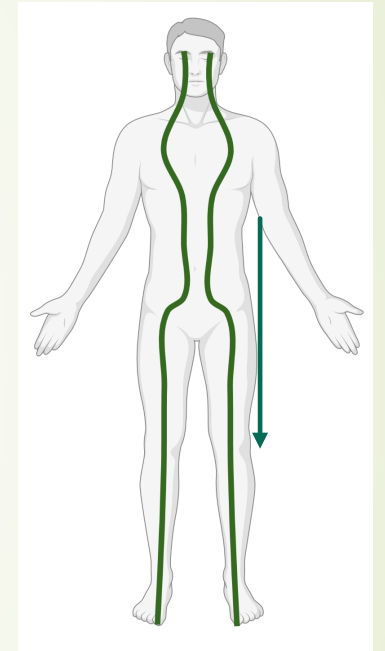
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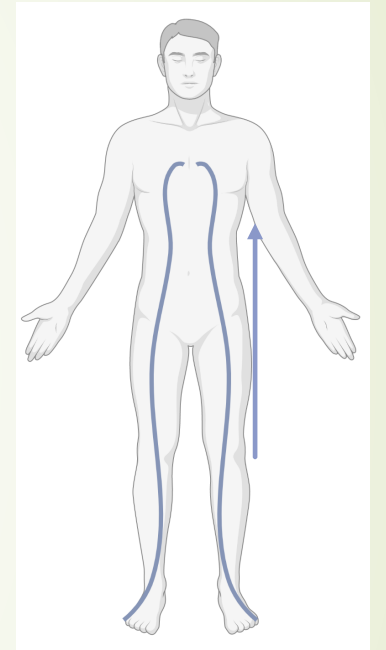
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➤ ~ 361 defined acupuncture points

- Majority occur at sites with a density of neurovascular bundles, often in close proximity to blood vessels and along fascia planes
- 99% of the points are within 0.5 mm of nerves, 96% are closely related to superficial nn in the skin, 80% are near an artery



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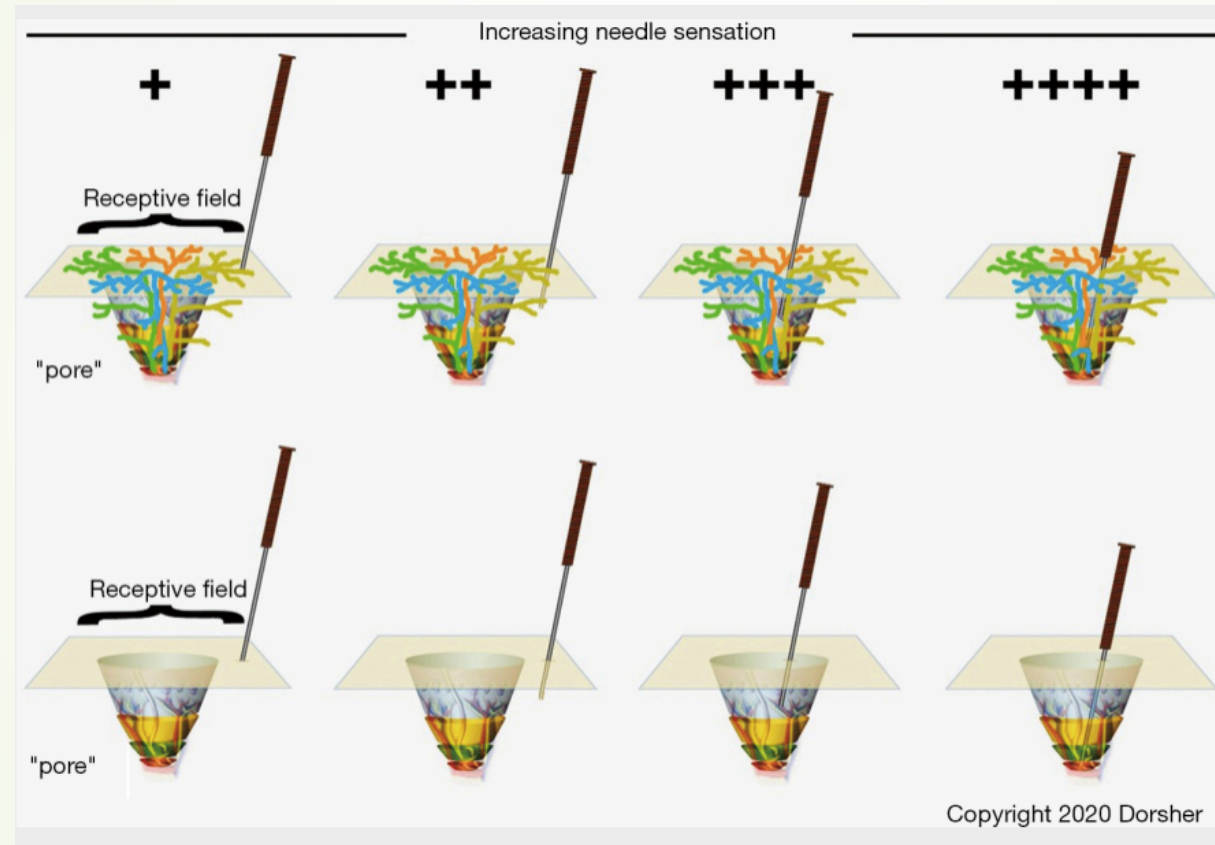


~ 361 defined acupuncture points



Dry needling, electro, aqua, laser.

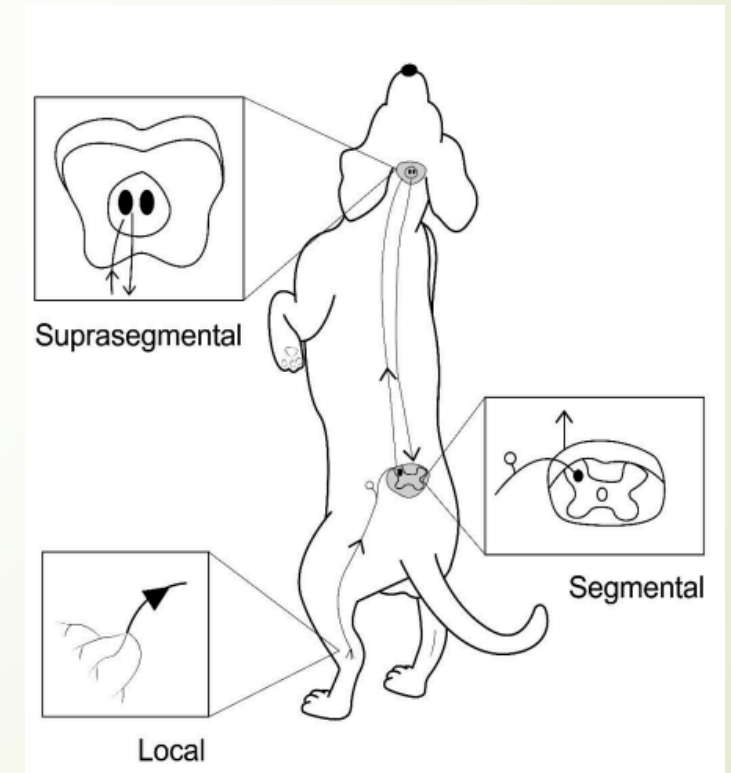
Acupoint stimulation and “dosing”



Dorsher PT, da Silva MAH. Acupuncture's neuroanatomic and neurophysiologic basis. *Longhua Chin Med* 2022;5:8. doi: 10.21037/lcm-21-48

Location of AP physiologic effect

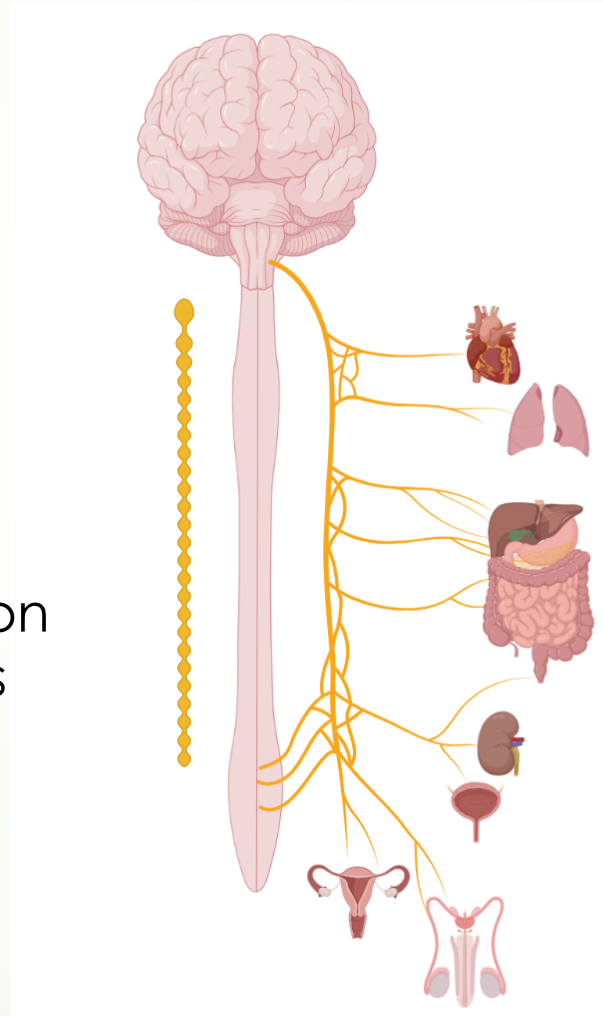
- Insertion of thin, sterile needles which stimulate physiologic processes through neural signaling
 - Local effect
 - Spinal, or segmental, effect
 - Brain, or suprasegmental, effect



Autonomic nervous system

Sympathetic

Increase energy
Increase HR
Increase respiration
Increase alertness



Parasympathetic

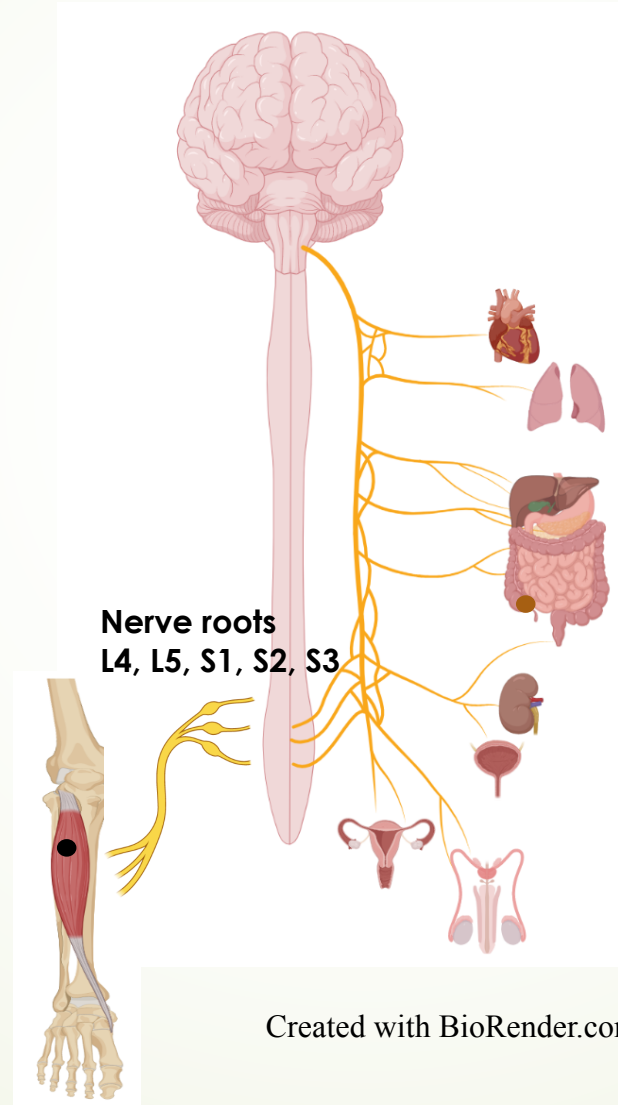
Decrease energy
Decrease HR
Decrease respiration
Decrease alertness
Anti-inflammatory
Decrease fear
Communication between
brain and gut



ST36: Stimulates local sensory n, signals through parasympathetic ns

- ▶ Highly innervated:
 - ▶ Deep fibular (peroneal)n., superficial fibular n, lateral sural cutaneous n, recurrent articular n.
 - ▶ Deep fibular n: connection to brain and spinal cord, produce autonomic (vagus nerve) neuromodulation and decreases sympathetic NS
- ▶ Used to treat GI disorders, general tonification for any weak condition, paralysis of pelvic limb, endocrine/metabolic disease

Vagal nerve stimulation via ST36





EAP at ST36 decreases inflammation via modulation of vagus

- ▶ Sepsis model: LPS injection
- ▶ +/- electroacupuncture at ST36, 10 Hz, 30 min
- ▶ +/- sectioning various nerves, +/- adrenalectomy or splenectomy
- ▶ +/- agonists/antagonists catecholamines, cytokines
- ▶ +/- genetically engineered mouse strains
- ▶ Measured serum cytokines, serum catecholamines, survival

Torres-Rosas, R., et.al. (2014). Nature Medicine, 20(3), 291-5.
doi:<http://dx.doi.org/10.1038/nm.3479>



EAP at ST36 decreases inflammation via modulation of vagus n/dopamine

LPS, 6 mg/kg, IP

Increased proinflammatory
cytokines

Decreased survival

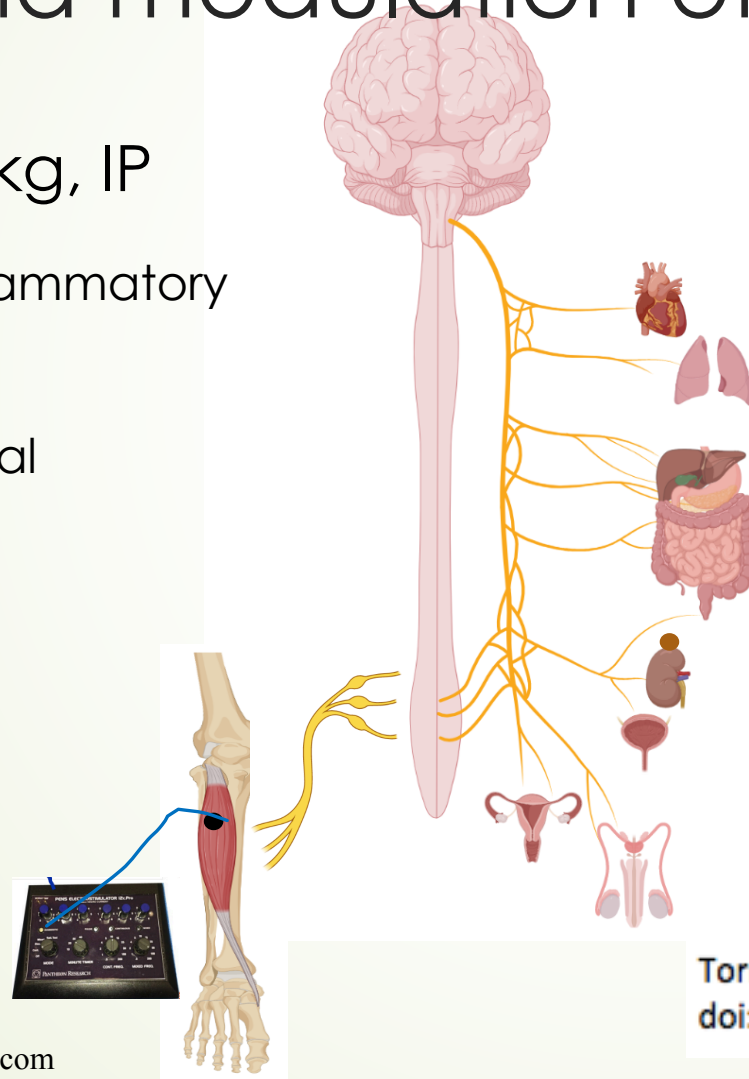
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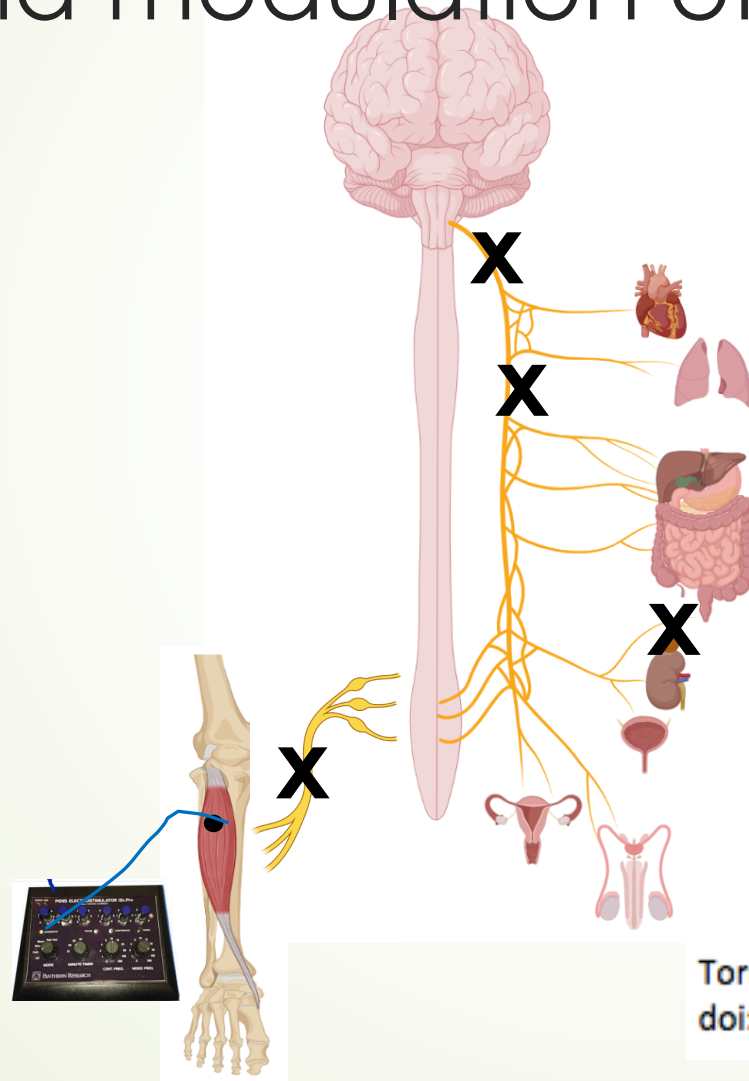
Increased serum catecholamines
Increased dopamine required to
inhibit inflammatory response

Increased survival

Serum from mice receiving EAP
decreased cytokines in control serum

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EAP at ST36 decreases inflammation via modulation of vagus n/dopamine



Sever sciatic, cervical vagus, subdiaphragmatic vagus; remove adrenal gland.

Decreased proinflammatory cytokines

Increased serum catecholamines
Increased dopamine required to inhibit inflammatory response

Increased survival

Serum from mice receiving EAP decreased cytokines in control serum

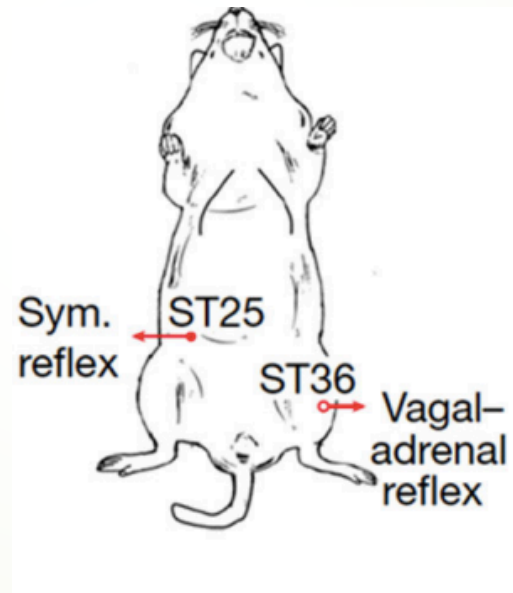
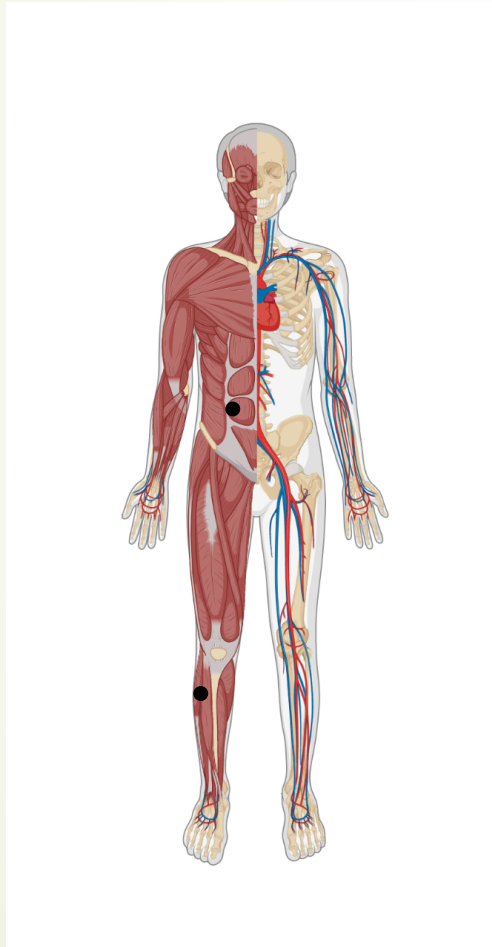
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EAP at ST36 decreases inflammation: Summary

- Sepsis increases inflammatory markers, morbidity, mortality
- EAP at ST36 decreases inflammation/mortality
- Requires intact sciatic n, vagus n, adrenal glands
- Requires dopamine production

EAP at ST36 but not ST25 stimulates vagal-adrenal axis



- LPS: 8-12 mg/kg
- +/- EAP, ST36 or ST25, 10 Hz, 15 min; 0.5-3 mA
- +/- sectioning various nerves
- +/- genetically engineered mouse strains
- Measured serum cytokines, survival



EAP at ST36 but not ST25 stimulates vagal-adrenal axis: Summary

- ▶ Low intensity EAP at ST36 but not ST25 inhibits inflammation via stim of vagus n
- ▶ High intensity EAP at either ST36 or ST25 inhibits inflammation via sympathetic reflex
- ▶ Somato–vagal–adrenal reflexes are driven by sensory pathways that innervate tissues unique to the hindlimbs
- ▶ EAP responses depend minimally on site, depth of needle insertion, and EAP parameters

Liu S, Wang ZF, Su YS, Ray RS, Jing XH, Wang YQ, Ma Q. Somatotopic Organization and Intensity Dependence in Driving Distinct NPY-Expressing Sympathetic Pathways by Electroacupuncture. *Neuron*. 2020 Nov 11;108(3):436-450.e7. doi: 10.1016/j.neuron.2020.07.015. Epub 2020 Aug 12. PMID: 32791039; PMCID: PMC7666081.

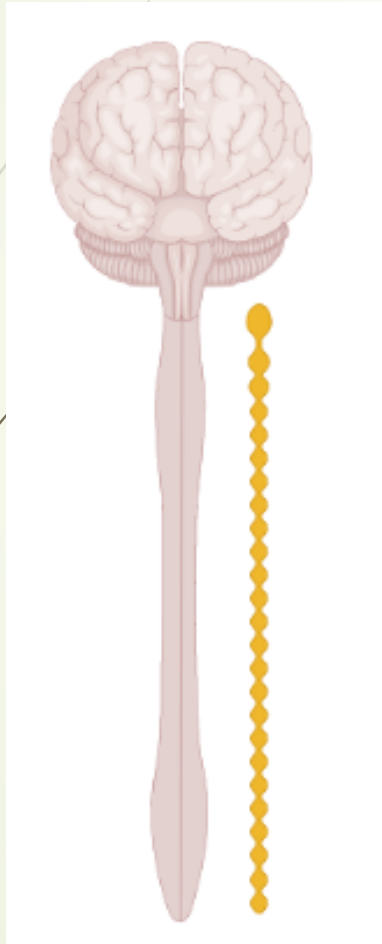
Liu, S., Wang, Z., Su, Y. *et al.* A neuroanatomical basis for electroacupuncture to drive the vagal-adrenal axis. *Nature* **598**, 641–645 (2021). <https://doi.org/10.1038/s41586-021-04001-4>

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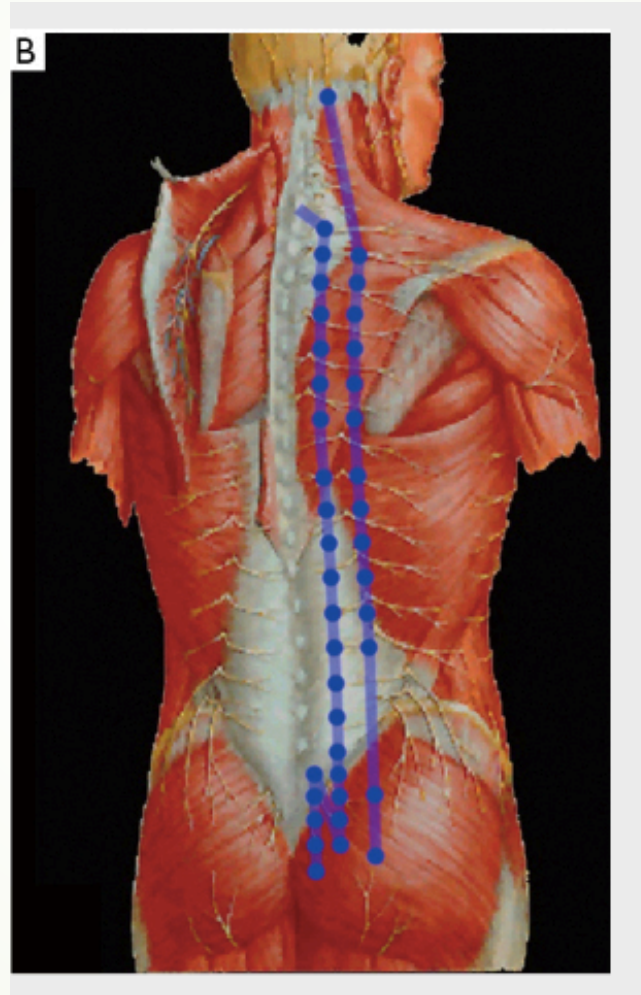
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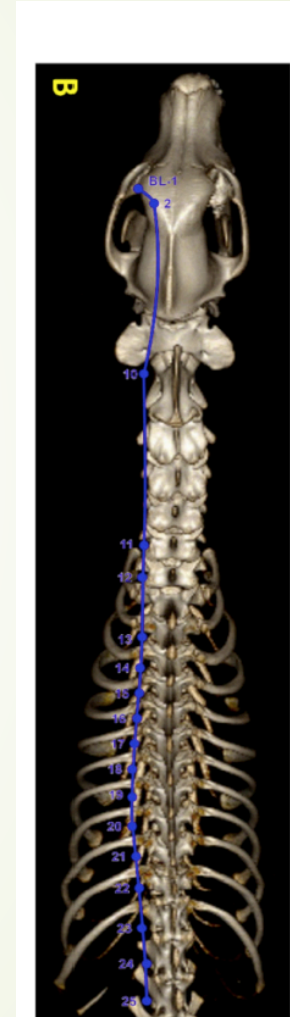
BL meridian aligns with sympathetic NS



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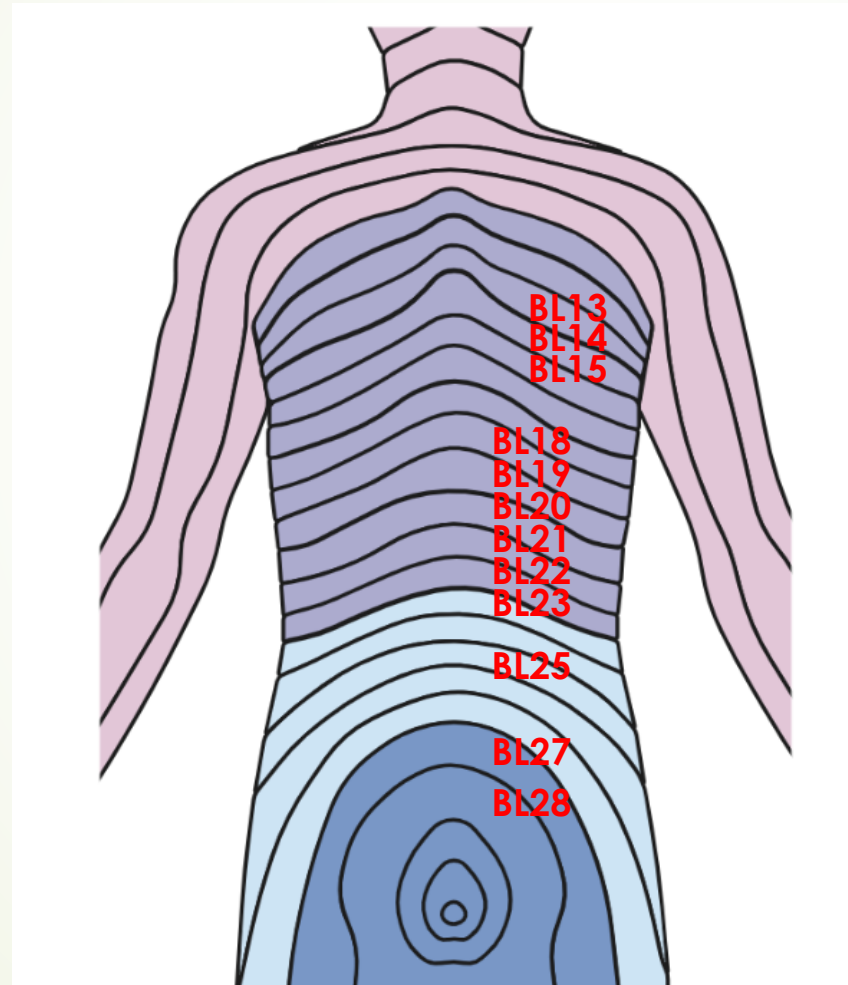


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CT image courtesy of Fred Winger VMD, DACVIM-Neurology.)

BL meridian aligns with sympathetic NS



- ▶ 12 BL points associated with specific organs in TCM
- ▶ 9 of the 12 acupoints exist at the same spinal segmental levels as the known anatomic segmental SANS outflow to their respective organs



Future directions of AP research

- Optimize animal models
 - Appropriate for condition studied? Consider anatomy, susceptibility, and also physiology.
 - Awake vs anesthetized.
 - Include appropriate controls.
 - Include (E)AP parameters used for stimulation.
- Single vs multiple points.
 - “Multimodal” approach; local, distal points.

Holistic approach to AP research



K. LISA YANG
BRAIN-BODY CENTER

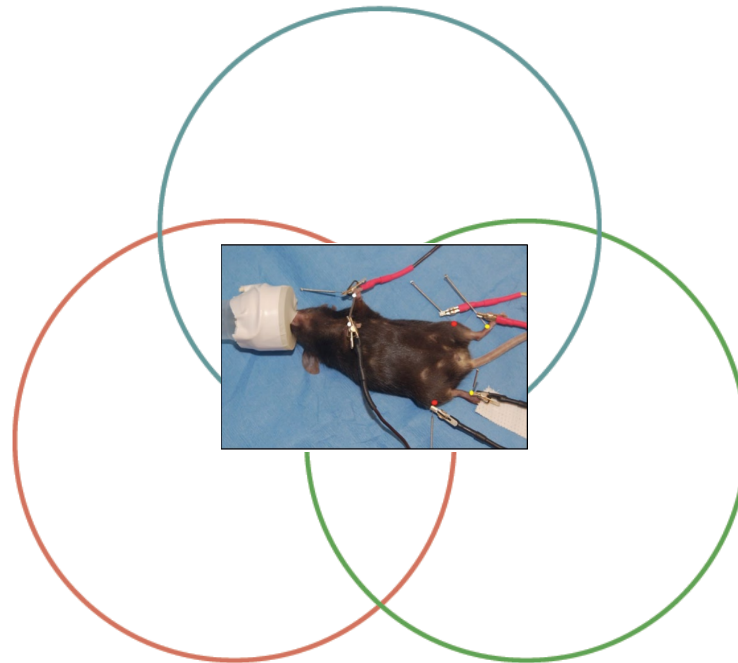


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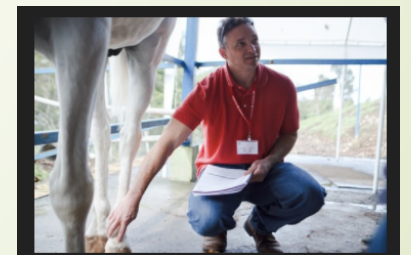
Neurobiology

Immunology/
Inflammation



Microbiome

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Questions?

