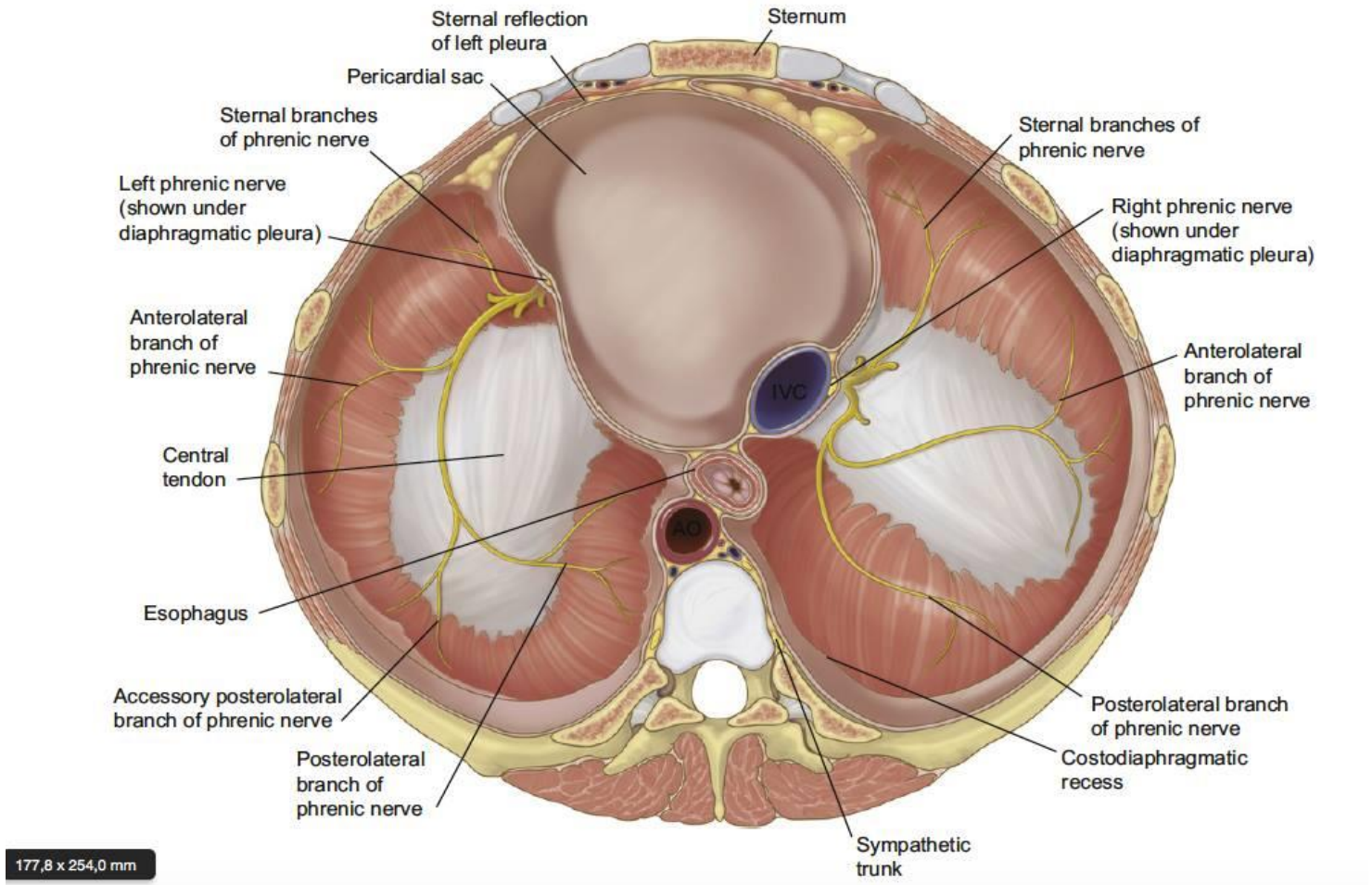
IMPLICACION CLÍNICA DEL NERVIO FRÉNICO

RAÚL SAN SEGUNDO RIESCO

Escuela de Osteopatía de Madrid
Internacional

NERVIO FRÉNICO

- Las fibras sensitivas del frénico inervan la porción central del diafragma incluyendo la porción pleural y peritoneal próxima.
- La porción subdiafragmática peritoneal del diafragma está inervada por estas fibras sensitivas.
- Los niveles cervicales C3-C5 reciben aferencias hacia el hombro procedentes de los nervios supraescapulares.



El septum transversal es el motor del crecimiento anatómico y embriológico del diafragma dado que acabará formando el tendón central del diafragma

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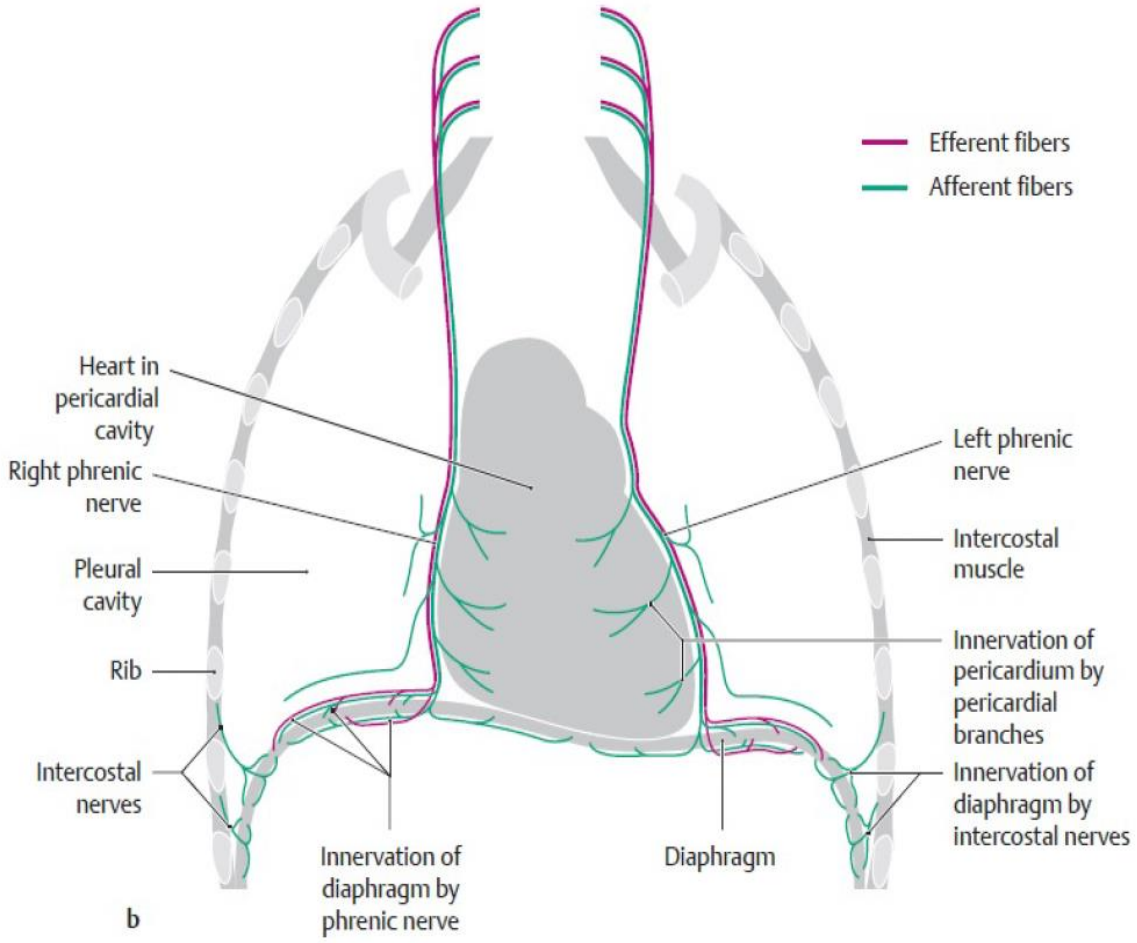
GENERALIDADES



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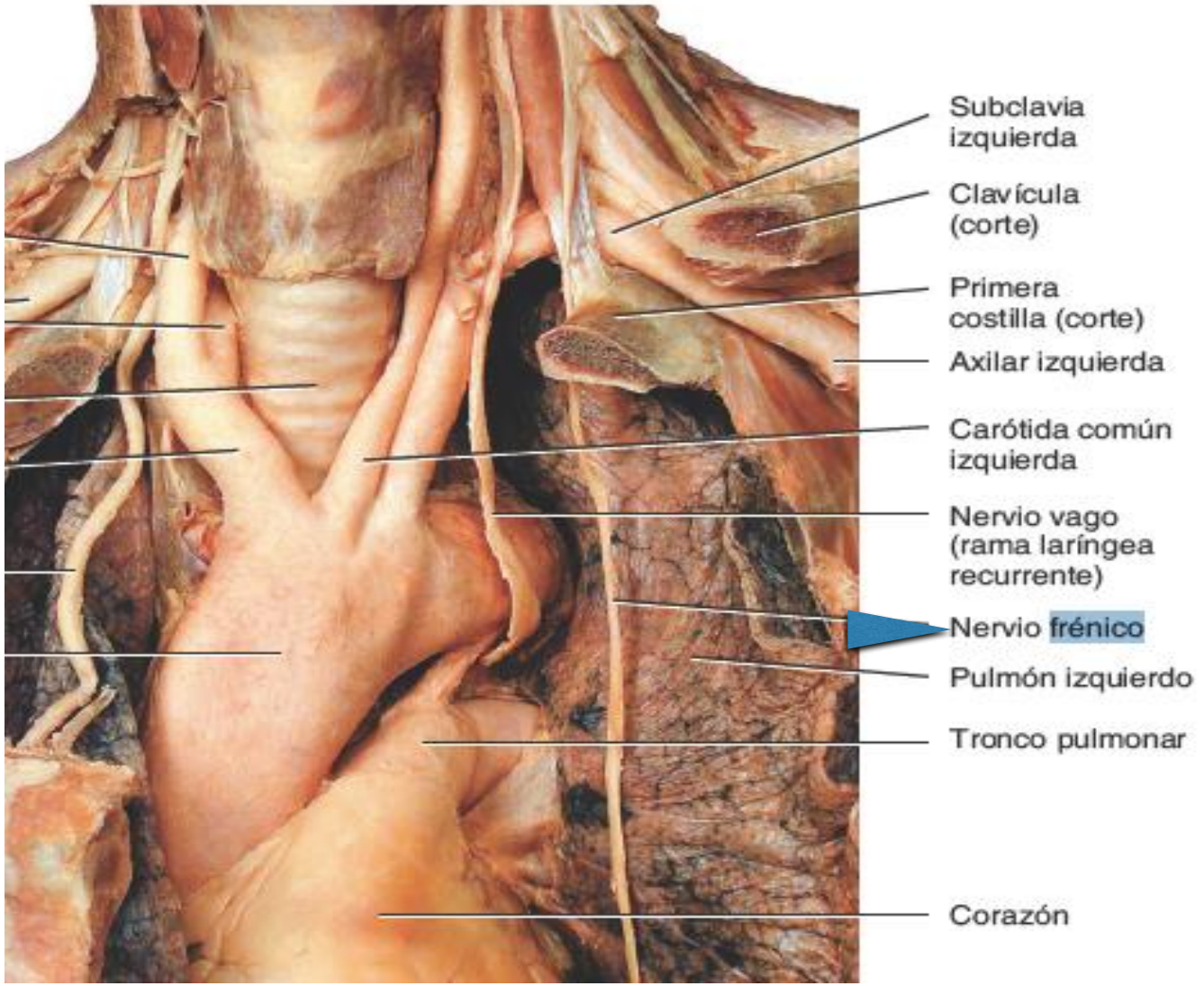
El pericardio está prácticamente inervado por el frénico



SHORT REPORT

Key words: phrenic nerve • sensory fibers • evoked potentials
MUSCLE & NERVE 18:1487–1489 1995

SOMATOSENSORY EVOKED POTENTIALS OF THE PHRENIC NERVE

UDO A. ZIFKO, MD, BRYAN G. YOUNG, MD, FRCP(C),
HUSSEIN REMTULLA, BSc, RT (EMG), and
CHARLES F. BOLTON, MD, FRCP(C)

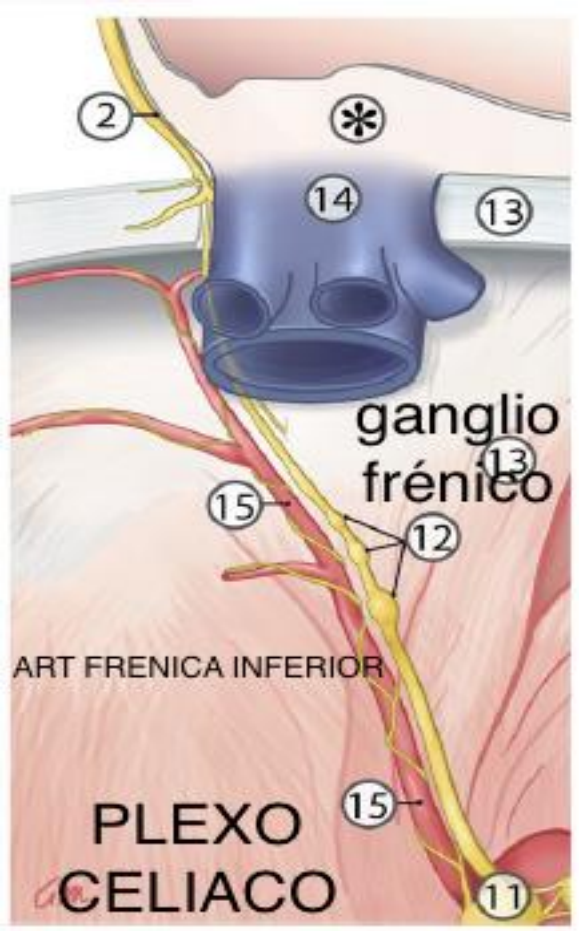
- El nervio frénico contiene las mismas fibras motrices que sensitivas. Recibe aferencias de la pleura, el ápex pleural, la parte superior del pericardio, la fascia que recubre el hígado (Cápsula de Glisson), la vesícula biliar y el páncreas.

GANGLIO FRÉNICO

The human phrenic nerve serves as a morphological conduit for autonomic nerves and innervates the caval body of the diaphragm

ESTE ESTUDIO DE LA COMPOSICIÓN HISTOLÓGICA DEL NERVIO FRÉNICO CONCLUYE QUE EL NERVIO FRÉNICO TIENE FIBRAS CATECOLAMINÉRGICAS, TÍPICAS DEL SISTEMA ORTOSIMPATICO.

SE DEMOSTRÓ QUE EL NERVIO FRÉNICO DERECHO SE ANASTOMOSA CON EL PLEXO CELIACO DERECHO Y LA GLÁNDULA SUPRARRENAL DERECHA.



GANGLIO FRÉNICO

Paraganglia at the level of the diaphragm. An unexpected finding in this study was the identification of paraganglia in the wall of the inferior caval vein where it passed the diaphragm. Based on their morphological appearance, the extensive venous network around NPPA-positive cells and the rich innervation by fibres arising from the phrenic nerve, we hypothesize that these structures have a neuroendocrine function like paraganglia elsewhere. Fibres of the phrenic nerve encircling the inferior caval vein have also been described in the foetus[35]. The presence of NPPA-positive granules further suggests that these cells have a role in regulating plasma volume in a similar manner as NPPA-containing cardiomyocytes. By analogy to the vagal B-type atrial receptors[36], which monitor central venous pressure as stretch of the atrial wall, the phrenic or autonomic nerve endings could act as low-pressure receptors for the central venous pressure. As elsewhere[37], the NPPA-positive cells could be under

Una de las sorpresas fue encontrarse un ganglio en la pared diafragmática próxima a la VCI. Se hipotetiza que este ganglio tiene una posible función neuroendocrina exisitendo una posible influencia en la regulación de la presión venosa a través de receptores de presión.

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GANGLIO FRÉNICO

Ann Anat 188 (2006) 85—92

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Considerations on the phrenic ganglia

Mugurel Constantin Rusu*

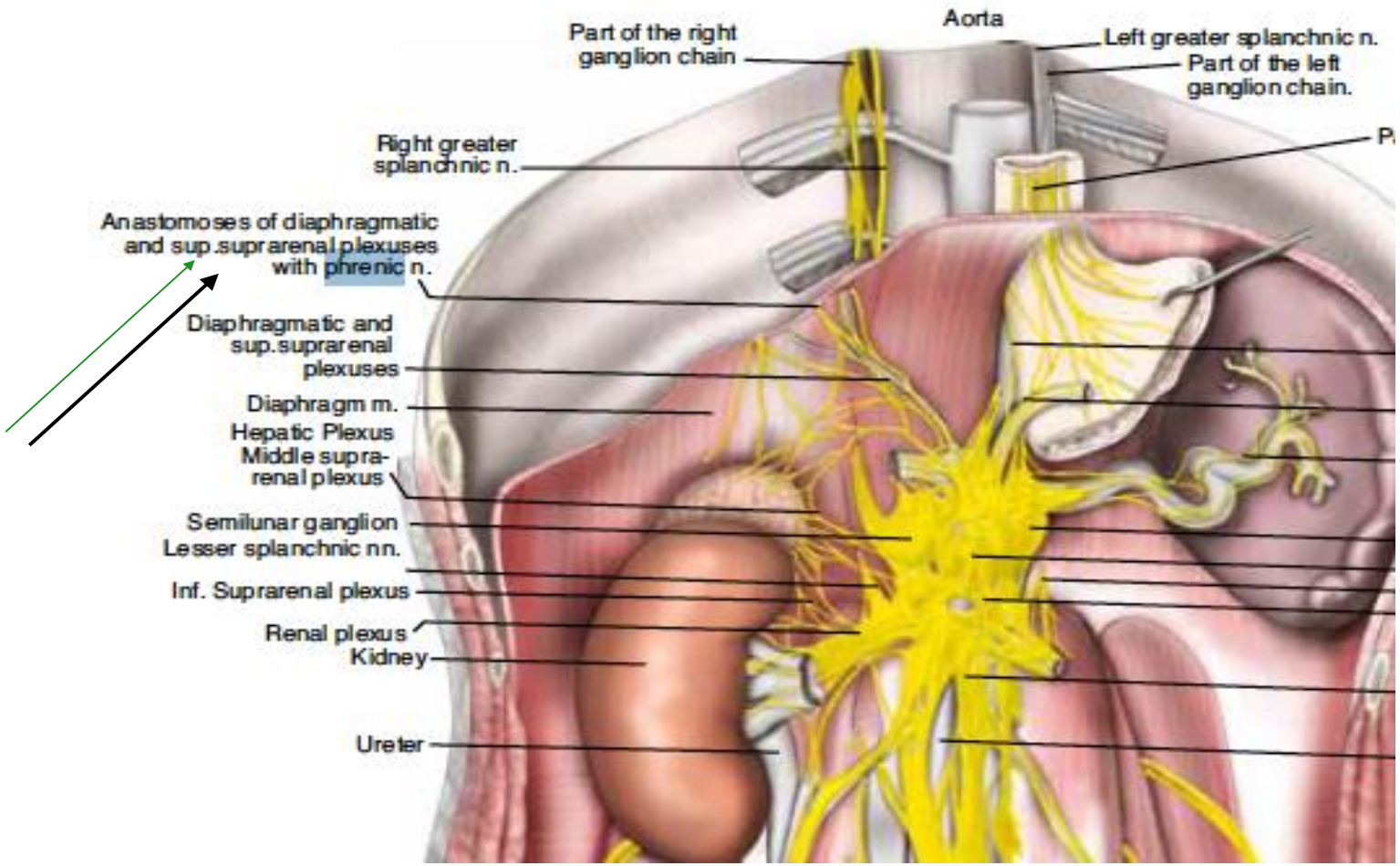
Department of Anatomy and Embryology, University of Medicine and Pharmacy "Carol Davila", Str.Anastasie Panu 1, bloc A2, scara 2, etaj 1, apart.32, sector 3, RO-031161 Bucharest, Romania

- **Summary**

The phrenic ganglion is described as a small ganglion located at the junction of the right phrenic nerve and branches of the celiac plexus, on the diaphragm. The descriptions of this ganglion are few and incomplete and justify the present study which has been performed macroscopically by dissection and microscopically using silver stained (the method of Bielschowsky) drawn pieces.

Dissections of 10 human adult specimens showed one or more ganglia located at the level of the terminal division of the right diaphragmatic artery; these ganglia belong to a trunk linking the right phrenic nerve and the celiac ganglion. In some specimens that nervous trunk was replaced by a ganglionated plexus. That trunk – the diaphragmatic nerve – attaches to a distinctive projection of the celiac ganglion; it may be double, but there is one ganglionated component. No left phrenic ganglia were detected. The macroscopic phrenic ganglia are distributed as follows: the lower to the adrenal gland and the upper to the diaphragm.

Microscopically, the ganglia had autonomic characteristics; intrinsic microganglia were also detected within the diaphragmatic nerve. Moreover, periadventitial nervous cells were detected on the right inferior phrenic artery.



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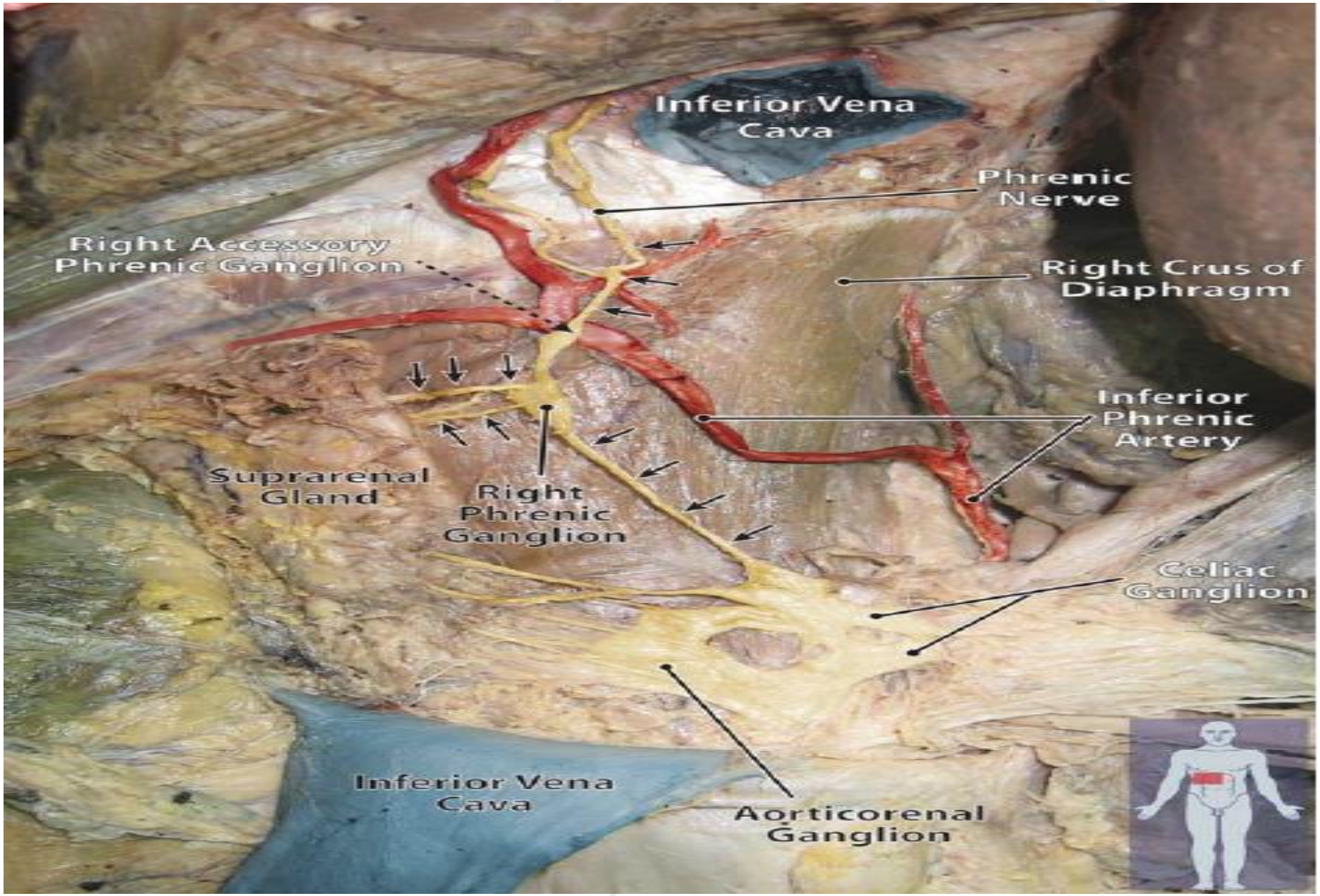

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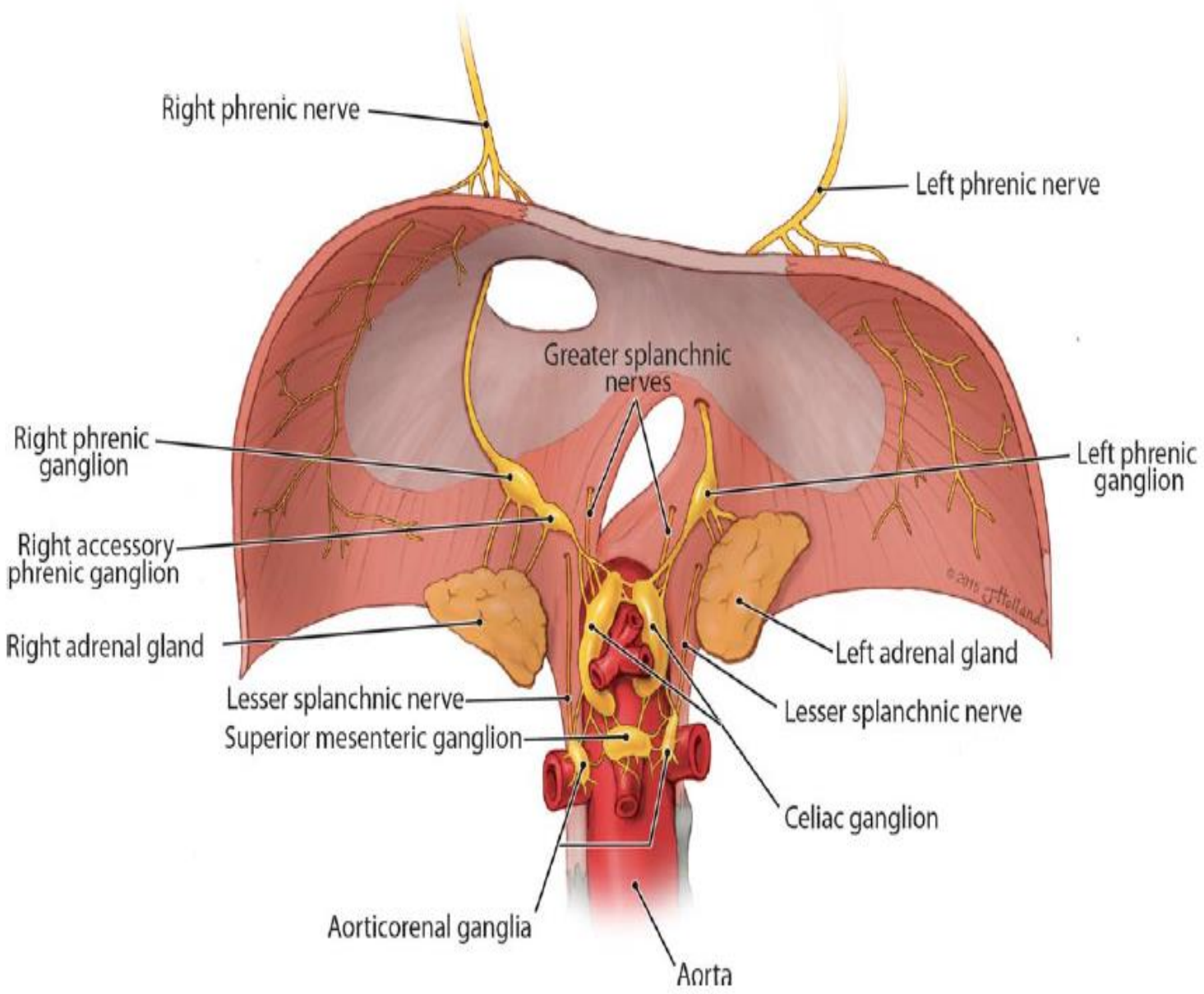

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RAMAS NERVIO FRENICO

- El nervio frénico, una vez atraviesa el diafragma, inerva la región subdiafragmática del peritoneo, anastomosándose con fibras del plexo celíaco para dar inervación a las vísceras abdominales.

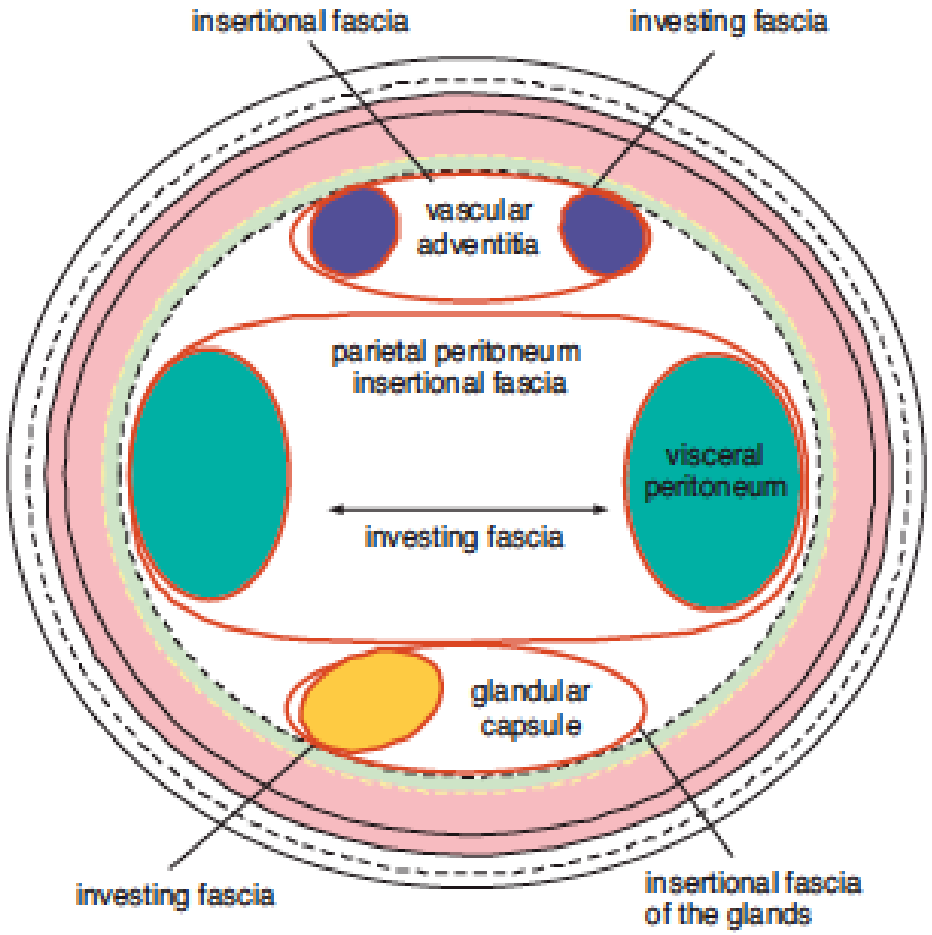
ORDEN FASCIAL MEDIO INTERNO

- LOS TEJIDOS FORMAN ORGANOS.
- LOS ORGANOS FORMAN APARATOS.
- LOS APARATOS FORMAN SISTEMAS.

- LOS SIST MUSCULAR, EPITELIAL,

TEJIDO CONECTIVO Y NERVIOSO ESTÁN

ÍNTIMAMENTE CONECTADOS +++



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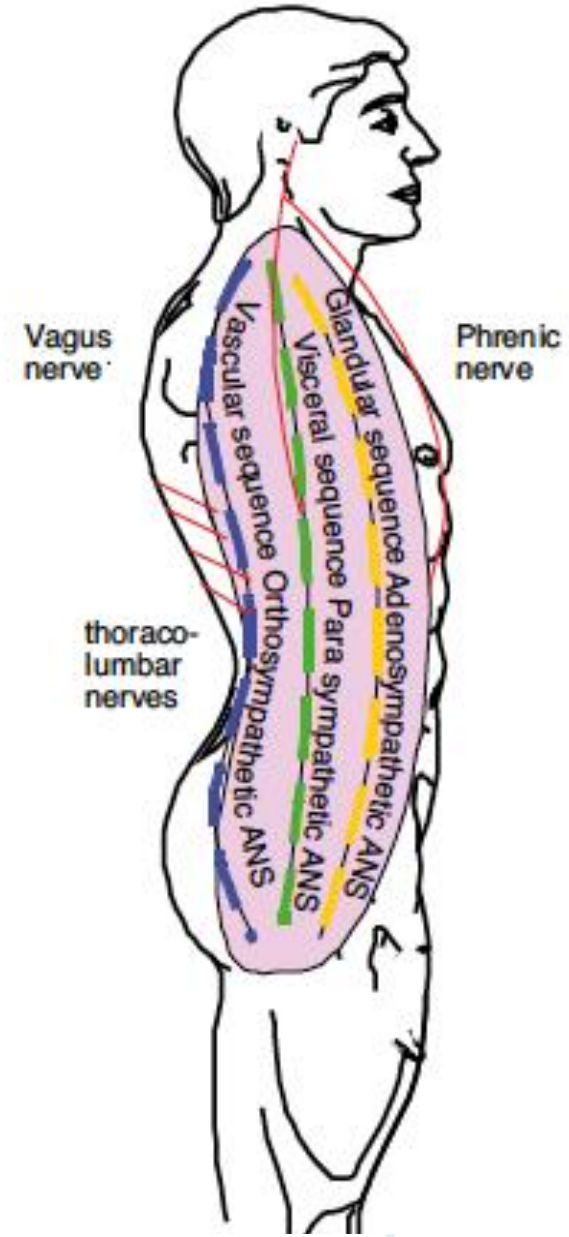
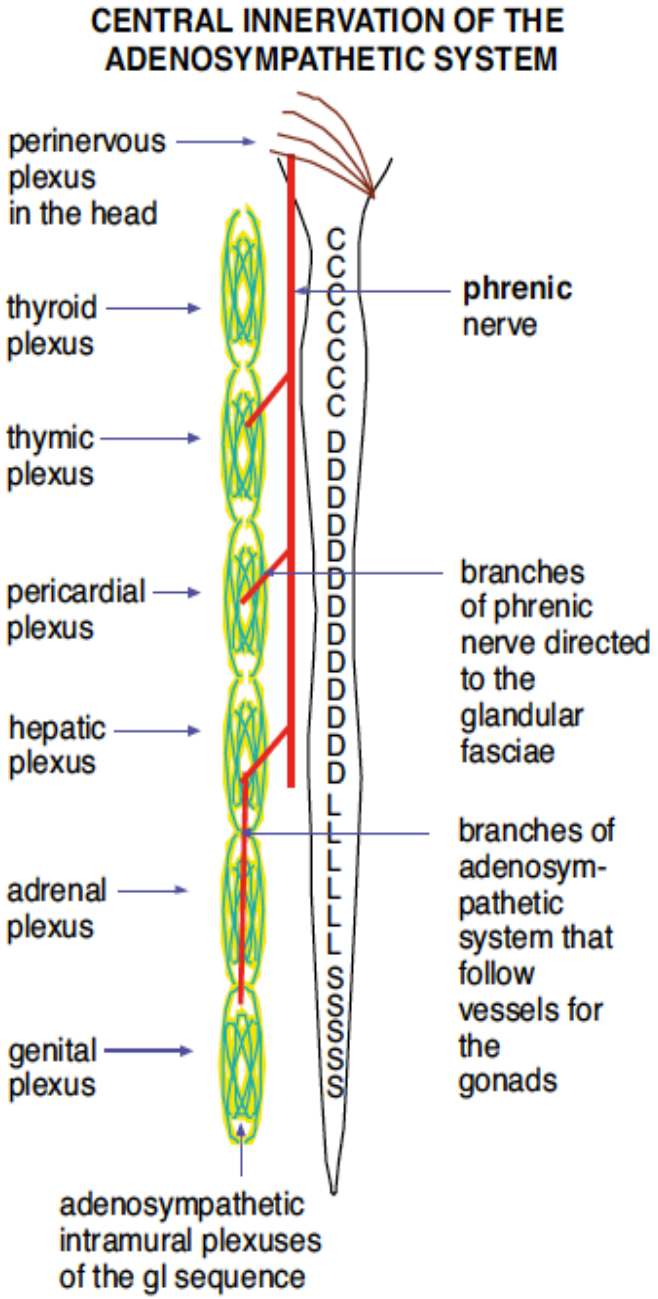
CONEXIÓN ENTRE SISTEMAS

- Tejido muscular formando parte de vísceras, vasos y glándulas.
- Tejido muscular presente en glándulas como la próstata.
- Las células mioepiteliales están inervadas por el sistema nervioso autónomo: sistema autónomo- glándula- muscular +++

CONEXIÓN ADRENAL

- El mesodermo da origen, entre otras cosas, al epitelio de revestimiento genitourinario y de la corteza de la glándula adrenal = musculatura y sistema glandular.
- La contracción de esta musculatura extrae las sustancias metabólicas que se expulsan de forma endo y paracrina por estas glándulas


Vagus nerve
Phrenic nerve
thoraco-lumbar nerves
Glandular sequence Adenosympathetic ANS
Visceral sequence Para sympathetic ANS
Vascular sequence Orthosympathetic ANS



Todos los plexos que rodean las cápsulas de estas glándulas forman el sistema adrenosimpático.

Esta secuencia glandular está conectada al sistema nervioso central a través de vías aferentes procedentes del nervio frénico.

Convergence of trigeminal input with visceral and phrenic inputs on primate C1–C2 spinothalamic tract neurons

Margaret J. Chandler *, Chao Qin, Yu Yuan, Robert D. Foreman

Department of Physiology, University of Oklahoma Health Sciences Center, P.O. Box 26901, Oklahoma City, OK 73190, USA

Accepted 2 March 1999

Abstract

Trigeminal, spinal and vagal afferent fibers overlap in C1–C2 segments. We hypothesized that trigeminal input from the superior sagittal sinus (SSS) can excite C1–C2 spinothalamic tract (STT) neurons receiving thoracic visceral or phrenic inputs. Effects of SSS stimulation were evenly divided among cells responding to each nerve stimulus; magnitude of responses to ipsilateral vagal input was greater in neurons excited by SSS input. Somatic fields of 80% of neurons responding to SSS stimulation included face areas innervated by the trigeminal nerve, whereas somatic fields of 89% of neurons unaffected by SSS stimulation were located only on areas innervated by cervical spinal nerves. Results are consistent with the idea that pain referred to trigeminal areas could originate in thoracic organs.

…n single C1–C2 dorsal horn neurons […
…agal, sympathetic and phrenic afferent …
…acic structures excite C1–C3 spinothala…
…eurons; these results provide a potentia…
…ain of cardiac origin that is referred to …

[13,14]. Results of the current study provide a neurophysiological basis for beginning to understand how visceral dysfunction, such as myocardial ischemia, might result in referred headache. Our findings support the idea that pain referred to trigeminal somatic areas could originate in structures innervated by visceral or phrenic nerves, and that convergence of nociceptive inputs from vagal fibers and the SSS might be particularly important in development of referred headache arising from visceral organs.

- Fibras del trigémino y del vago se superponen con los niveles C1-C2.
- Dolor recibido en el trigémino pudiera proceder de órganos torácicos +++.
- El dolor referido a estructuras somáticas trigeminales puede proceder de regiones viscerales o del nervio frénico.

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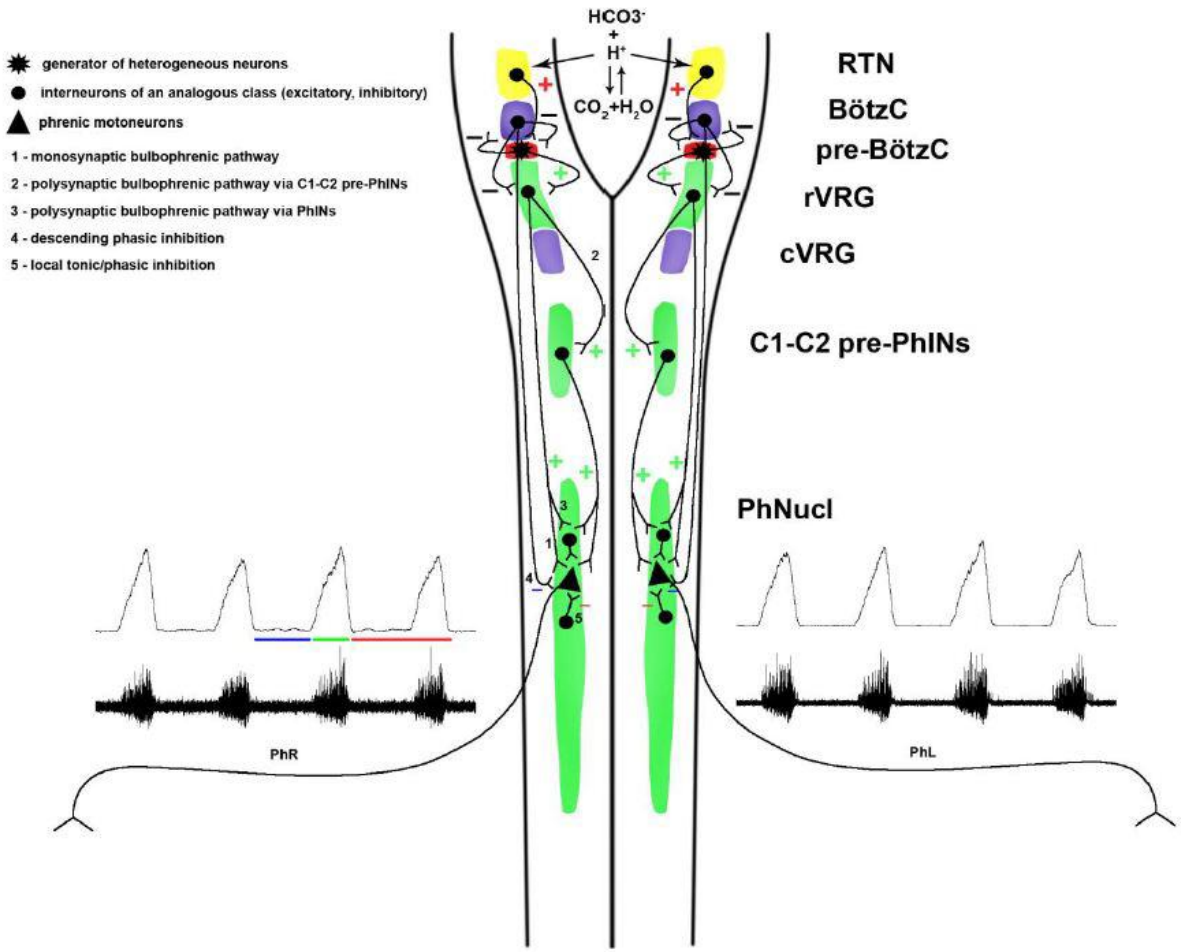
Medullary Drive to Phrenic Nucleus



Joel C. Razook, Margaret J. Chandler and Robert D. Foreman *

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(Received 28 August 1994, revision received 5 January 1995, accepted 22 January 1995)

Summary Effects of electrical stimulation of the ipsilateral phrenic nerve above the heart were determined on cells in the C_1-C_2 spinal cord segments of 27 rats anesthetized with pentobarbital. Forty-five cells that responded to this stimulus were included in this study. These cells then were examined at the same stimulus parameters for effects of stimulating the ipsilateral phrenic nerve below the heart, the contralateral phrenic nerve above the heart, and/or the left (ipsilateral) cervical vagus nerve. Ipsilateral phrenic nerve stimulation below the heart had no effect on 20 of 20 cells tested. Seven of 16 cells tested for effects of contralateral phrenic nerve stimulation above the heart were excited and activity of 9 cells was unaffected. Activity changes and activation latencies were not significantly different in the 7 cells excited by both ipsilateral and contralateral phrenic nerve stimulation. Thirty-seven of 45 cells excited by ipsilateral phrenic nerve stimulation also were excited by stimulation of the left cervical (ipsilateral) vagus nerve. The mean increase in cell activity was significantly greater following vagal nerve stimulation compared to phrenic nerve stimulation, and mean activation latency was significantly longer for vagal stimulation. Excitatory receptive somatic fields were classified for 35 cells. Somatic field locations for most cells (80%) included the ipsilateral neck and jaw. Activity of 26 cells was increased by both noxious pinch and brushing the hair, activity of 6 cells was increased only by noxious pinch, and activity of 3 cells was increased only by brushing the hair. Results of this study indicate that there are afferent fibers in the phrenic nerve above the heart, but not below the heart, that excite cells in the C_1-C_2 segments of the spinal cord. Most cells also were excited by noxious stimuli applied to their somatic receptive fields. Thus, the phrenic nerve may provide a pathway for referral of pain to the neck and jaw from thoracic structures.

El nervio frénico puede proporcionar una vía de transmisión de dolor referido a la región cervical y la ATM desde la región torácica.

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Fibras 1 y 2: Contracción del diafragma.

Fibras 3 y 4: contracción y relajación del diafragma

- El 30-45% de las fibras aferentes son sensitivas.
- Fibras 1a,1b y II descargan a lo largo de la contracción del diafragma (son largas y mielinizadas) y las pequeñas (III; pequeño diámetro y mielinizada; IV dismielinizada y de pequeño tamaño). III y IV descargan a lo largo del ciclo respiratorio.

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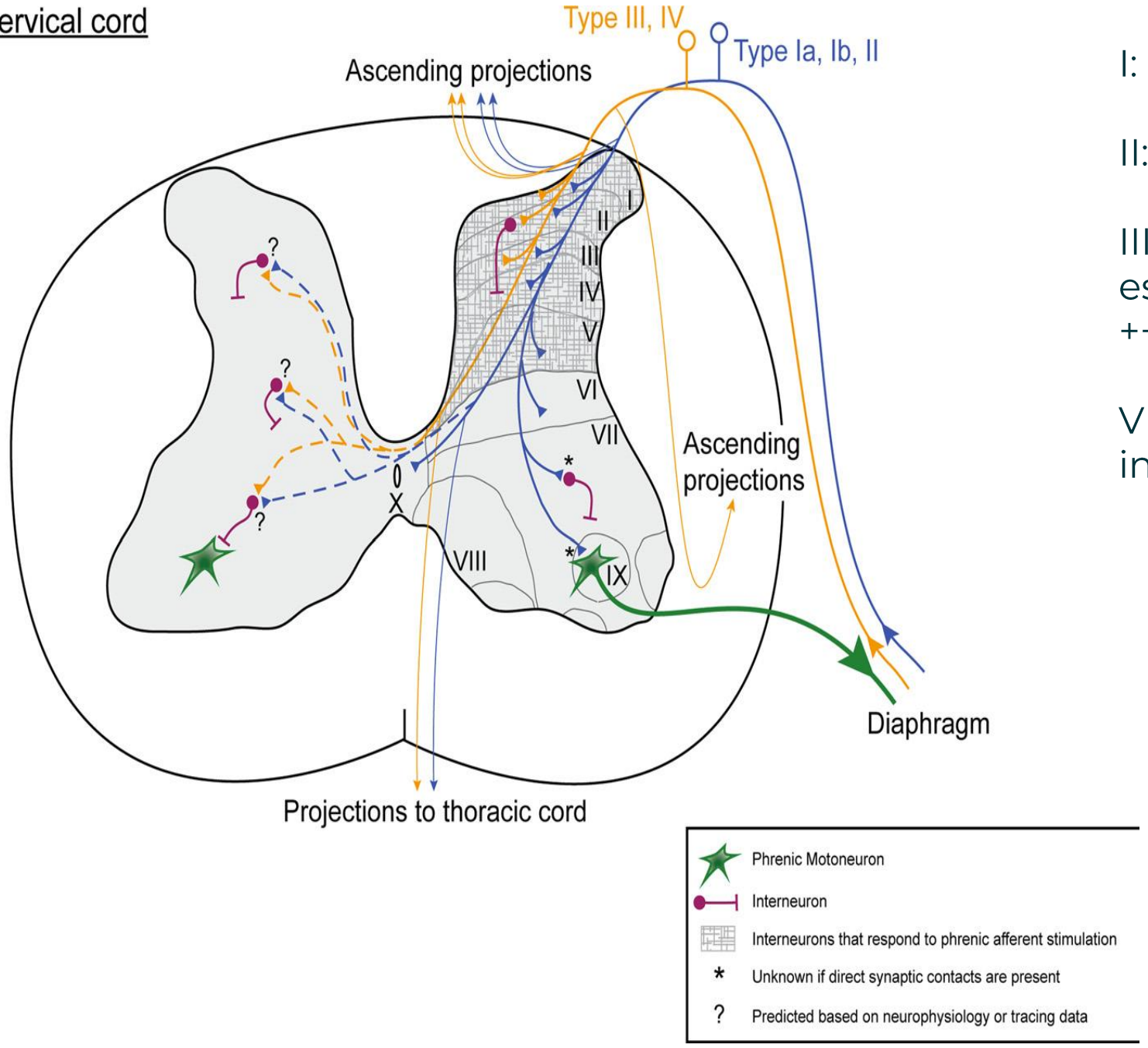

I: DOLOR Y TEMPERATURA

II: NOCICEPCIÓN (Conexión 5).

III y IV: Dolor y Tacto (Fascículo espinotalámico antero-lateral +++)

V y VI: Propiocepción inconsciente ++++

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J Appl Physiol 94: 220–226, 2003.
First published August 23, 2002; 10.1152/japplphysiol.00334.2002.

Activation of thalamic ventroposteriolateral neurons by phrenic nerve afferents in cats and rats

WEIRONG ZHANG AND PAUL W. DAVENPORT
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Submitted 15 April 2002; accepted in final form 16 August 2002

- El diafragma se encuentra inervado por **propioceptores** que son capaces de proyectar **información aferente de la longitud del músculo y de su tensión** propia como el resto de los músculos costales al sistema nervioso central.
- Este estudio proporciona los primeros datos de conexión entre los núcleos centrales posteriores del tálamo y el sistema respiratorio.

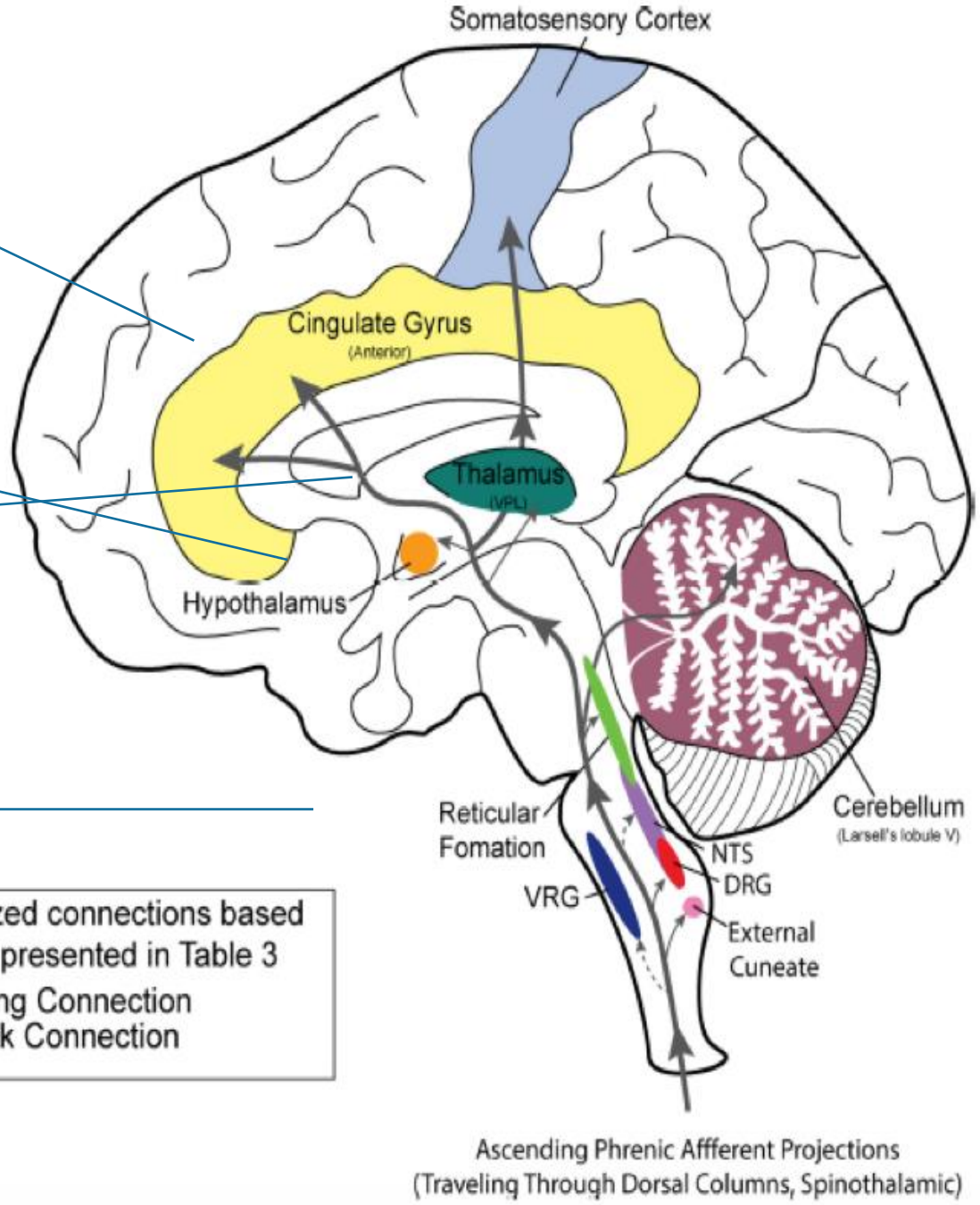
  La alteración de la función del diafragma registró una modificación de la información que el nervio frénico proporciona al tálamo

Función autonómica, emoción y memoria

Regulación de la temperatura corporal, la frecuencia cardíaca, la sed, el hambre, los ciclos de sueño y la **presión arterial** (homeostasis).

Información sensorial menos olfato

Niveles de consciencia



- Para oler necesariamente hay que inspirar. El sentido del olfato llega al sistema límbico sin hacer relevo en el tálamo.
- la estimulación directa del sistema límbico olfatorio modifica el patrón respiratorio.

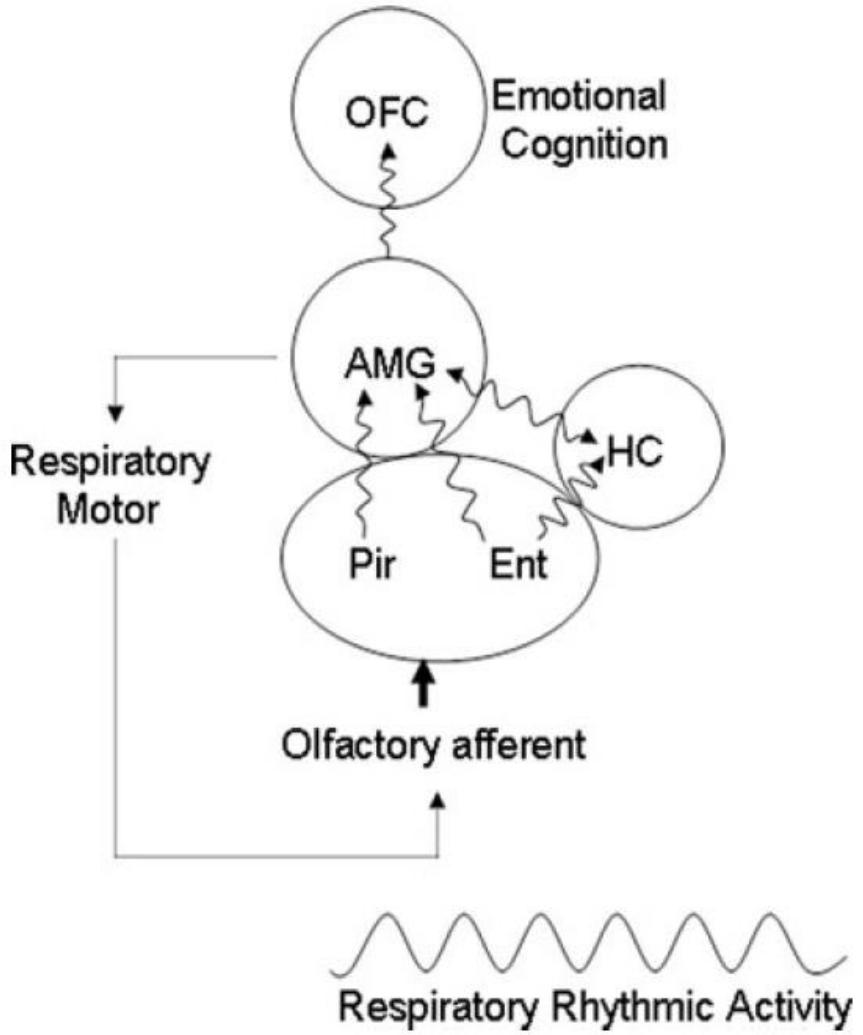


Figure 9. Schematic representation of connections of orbitofrontal cortex (OFC), amygdala (AMG), piriform cortex (Pir), entohinal cortex (Ent) and hippocampus (HC) with respiratory rhythm

Exp Physiol 93.9 pp 1011–1021

Experimental Physiology – *Review Article*

Breathing rhythms and emotions

Ikuo Homma and Yuri Masaoka

Department of Physiology, Showa University School of Medicine, Tokyo, Japan

Respiration is primarily regulated for metabolic and homeostatic purposes in the brainstem. However, breathing can also change in response to changes in emotions, such as sadness, happiness, anxiety or fear. Final respiratory output is influenced by a complex interaction between the brainstem and higher centres, including the limbic system and cortical structures. Respiration is important in maintaining physiological homeostasis and co-exists with emotions. In this review, we focus on the relationship between respiration and emotions by discussing previous animal and human studies, including studies of olfactory function in relation to respiration and the piriform–amygdala in relation to respiration. In particular, we discuss oscillations of piriform–amygdala complex activity and respiratory rhythm.

- La acción del diafragma está también controlado por estados emocionales como tristeza, miedo, ansiedad y rabia.
- Existen interacciones entre la médula espinal, sistema límbico y corteza cerebral.

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Baroreceptor activation attenuates attentional effects on pain-evoked potentials

Marcus A. Gray, Ludovico Minati, Giulia Paoletti, Hugo D. Critchley

Fondazione IRCCS Istituto Neurologico "C. Besta"

Research output: Contribution to journal › Article

Percepción del dolor disminuye si se respira profundamente y se mantiene la respiración. Provoca descenso en la frecuencia cardiaca.

La intervención de los barorreceptores disminuye el tono del musculo diafragma al reducir la actividad del sistema simpático

RESPIRACIÓN Y SISTEMA LÍMBICO

- La más importante aferencia para la regulación de la respiración envuelve quimiorreceptores que hacen feed-back con la actividad muscular inspiratoria.
- EL origen del control voluntario de la respiración está en el córtex cerebral. De hecho ,se comprobó que estimulando el córtex se producía contracción del diafragma e intercostales.
- Importante la modulación de la inspiración para generar modificaciones en los receptores que puedan inducir cambios en el SNC +++

- Las modificaciones en los patrones respiratorios procedente de los centros superiores pudiesen cambiar nuestra forma de respirar.
- Cambios en los patrones respiratorios respondiendo a estrés mental, ansiedad, afectando al patrón ESPIRATORIO.
- AMIGDALA PROCESA LAS EMOCIONES NEGATIVAS DE MIEDO Y ANSIEDAD.
- LA ESTIMULACION ELECTRICA DE LA AMIGDALA AUMENTAN LOS CICLOS RESPIRATORIOS. ADEMAS PROVOCA SIGNOS DE MIEDO INCLUYENDO RESPUESTAS AUTONÓMICAS Y FISIOLOGICAS
- AUMENTO DE LOS CICLOS RESPIRATORIOS PROCEDE DE LA AMIGDALA DE FORMA INCONSCIENTE

frontiers in Psychology

ORIGINAL RESEARCH
published: 06 June 2017
doi: 10.3389/fpsyg.2017.00874

The Effect of Diaphragmatic Breathing on Attention, Negative Affect and Stress in Healthy Adults

Xiao Ma[1,2], Zi-Qi Yue[3], Zhu-Qing Gong[4,5], Hong Zhang[3], Nai-Yue Duan[3], Yu-Tong Shi[3], Gao-Xia Wei[5,6] and You-Fa Li[2]**

[1] Faculty of Psychology, Beijing Normal University, Beijing, China, [2] Collaborative Innovation Center of Assessment toward Basic Education Quality, Beijing Normal University, Beijing, China, [3] College of P.E. and Sports, Beijing Normal University, Beijing, China, [4] Department of Psychology, University of Chinese Academy of Sciences, Beijing, China, [5] Key Laboratory of Behavioral Science, Institute of Psychology, Chinese Academy of Sciences, Beijing, China, [6] Department of Psychiatry, Massachusetts General Hospital, Harvard Medical School, Boston, MA, United States

- Estudios con electroencefalograma sugieren que la meditación, el yoga y la respiración activa en forma de ejercicios diarios incrementan la actividad B en el frontal izquierdo, línea media y lóbulo occipital .

EL NUCLEO RETROAMBIGUO CONTROLA LOS CENTROS RESPIRATORIOS. ES POSIBLE INFLUIR EN LA FRECUENCIA RESPIRATORIA Y CARDIACA CON EL HUESO OCCIPITAL.

Pickering M, Jones JF. The diaphragm: two physiological muscles in one. *J Anat*. 2002;201(4):305–312.

Kwan CS, Worrilow CC, Kovelman I, Kuklinski JM. Using suboccipital release to control singultus: a unique, safe, and effective treatment. *Am J Emerg Med*. 2012;30(3):514. e5–e7.

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