

El proceso Neurobiológico del Amor y la separación de la pareja

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SALUD
SECRETARÍA DE SALUD

Supervivencia:

alimentarse
reproducirse
heredar genes a las próximas generaciones



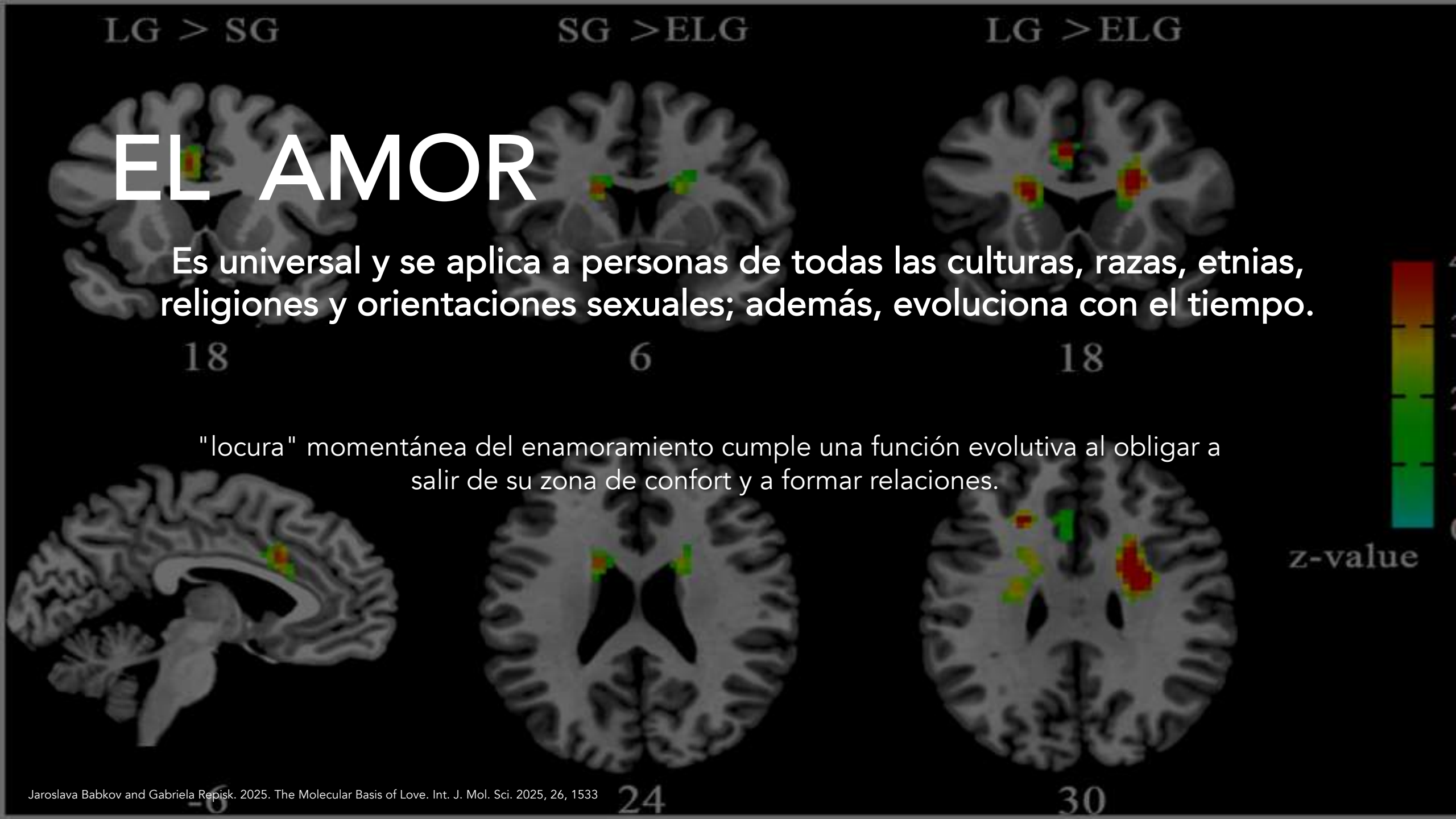
•Inagaki, T. K., & Eisenberger, N. I. (2012). Neural correlates of giving support to a loved one. *Psychosom Med*, 74(1):3-7. doi: 10.1097/PSY.0b013e3182359335
•Berridge, K. C., & Kringelbach, M. L. (2015). Pleasure systems in the brain. *Neuron*, 86(3):646-64. doi: 10.1016/j.neuron.2015.02.018

EL AMOR

El amor romántico implica componentes cognitivos, emocionales y conductuales.

Cognitivamente, se caracteriza por pensamientos intrusivos sobre la pareja, idealización y un fuerte deseo de comprensión mutua. La emoción reduce la inteligencia y la conducta modifica la interacciónyatención prosocial.

Jaroslava Babkov and Gabriela Repisk. 2025. The Molecular Basis of Love. Int. J. Mol. Sci. 2025, 26, 1533



EL AMOR

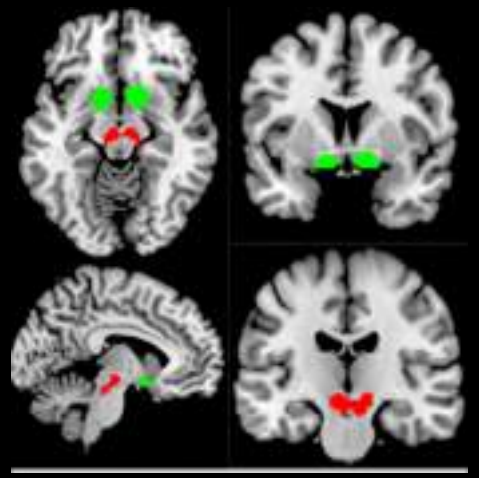
Es universal y se aplica a personas de todas las culturas, razas, etnias, religiones y orientaciones sexuales; además, evoluciona con el tiempo.

"locura" momentánea del enamoramiento cumple una función evolutiva al obligar a salir de su zona de confort y a formar relaciones.

Jaroslava Babkov and Gabriela Repisk. 2025. The Molecular Basis of Love. Int. J. Mol. Sci. 2025, 26, 1533

EL AMOR

(1) No es necesariamente diádico, social o interpersonal.
(2) No es una emoción.
(3) No solo tiene efectos positivos.
(4) No es incontrolable.
(5) No existe una región cerebral, neurotransmisor u hormona específica para el amor.
(6) La manipulación farmacológica del amor romántico no está cerca.



Sandra J. E. Langeslag 2024. Refuting Six Misconceptions about Romantic Love Behav. Sci. 2024, 14, 383. https://doi.org/10.3390/bs14050383

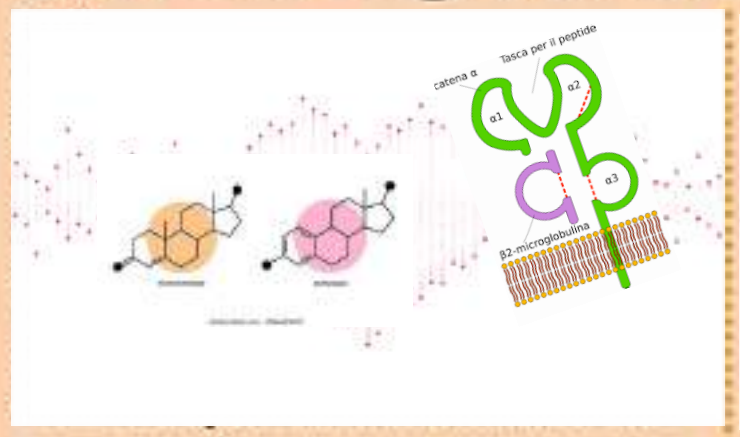
Jaroslava Babkov and Gabriela Repisk. 2025. The Molecular Basis of Love. Int. J. Mol. Sci. 2025, 26, 1533

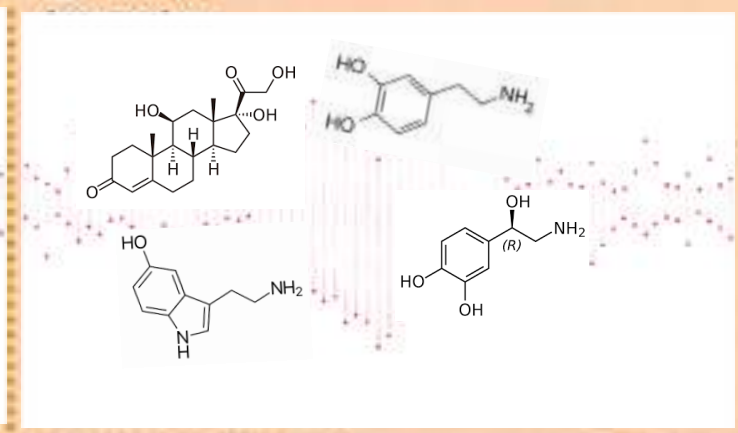
Review

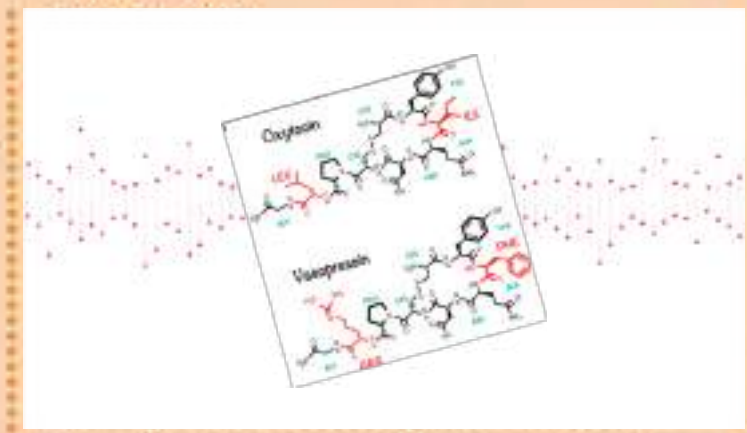
The Neurobiological Basis of Love: A Meta-Analysis of Human Functional Neuroimaging Studies of Maternal and Passionate Love

Hsuan-Chu Shih [1,2,3], Mu-En Kuo [1,2], Changwei W. Wu [4], Yi-Ping Chao [5], Hsu-Wen Huang [6] and Chih-Mao Huang [1,2,7,*]

The three stages of falling in love













STOP FACTS ABOUT LOVE	1 Motivante	Apasionado 2	Monogamia 3	4 Incongruente	Obsesivo 5

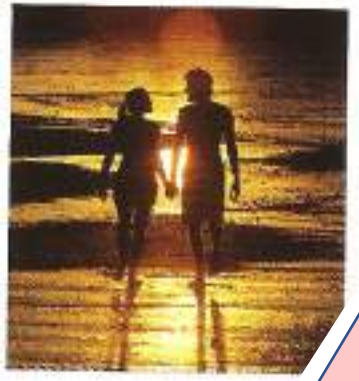
Mirar a la persona amada en 3 minutos puede generar un ritmo cardiaco coordinado

The science in LOVE



Neuroscience of Love

Robert Stemberg



Cariño
Intimidad



Amor romántico

Amor de compañeros

CONSUMMATE LOVE
INTIMACY + PASSION + COMMITMENT

Capricho
Pasión

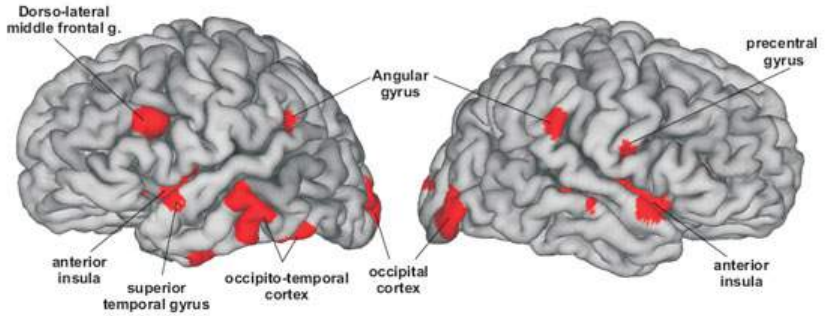
Compromiso

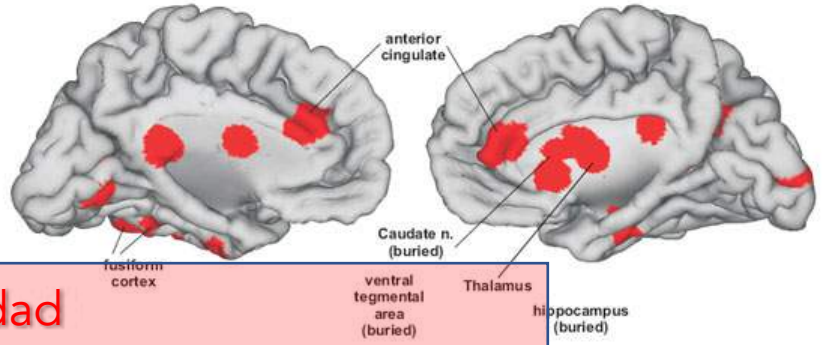
Amor inconsistente



TalenTU
Trasciende tu potencial, expande tu universo
by UCIC

Human Brain Book. 2009. Rita Carter.





Reduce la ansiedad

inmuno-modulador

Incrementa la fertilidad,
reduce la presión arterial

Motivación

Modifica el umbral de nocicepción

Felicidad

Obsesión

¿Amor o enamoramiento?

Cuando nos enamoramos
en realidad no se ve al otro en su totalidad…
el otro funciona como una pantalla
donde proyectamos nuestros aspectos
idealizados….



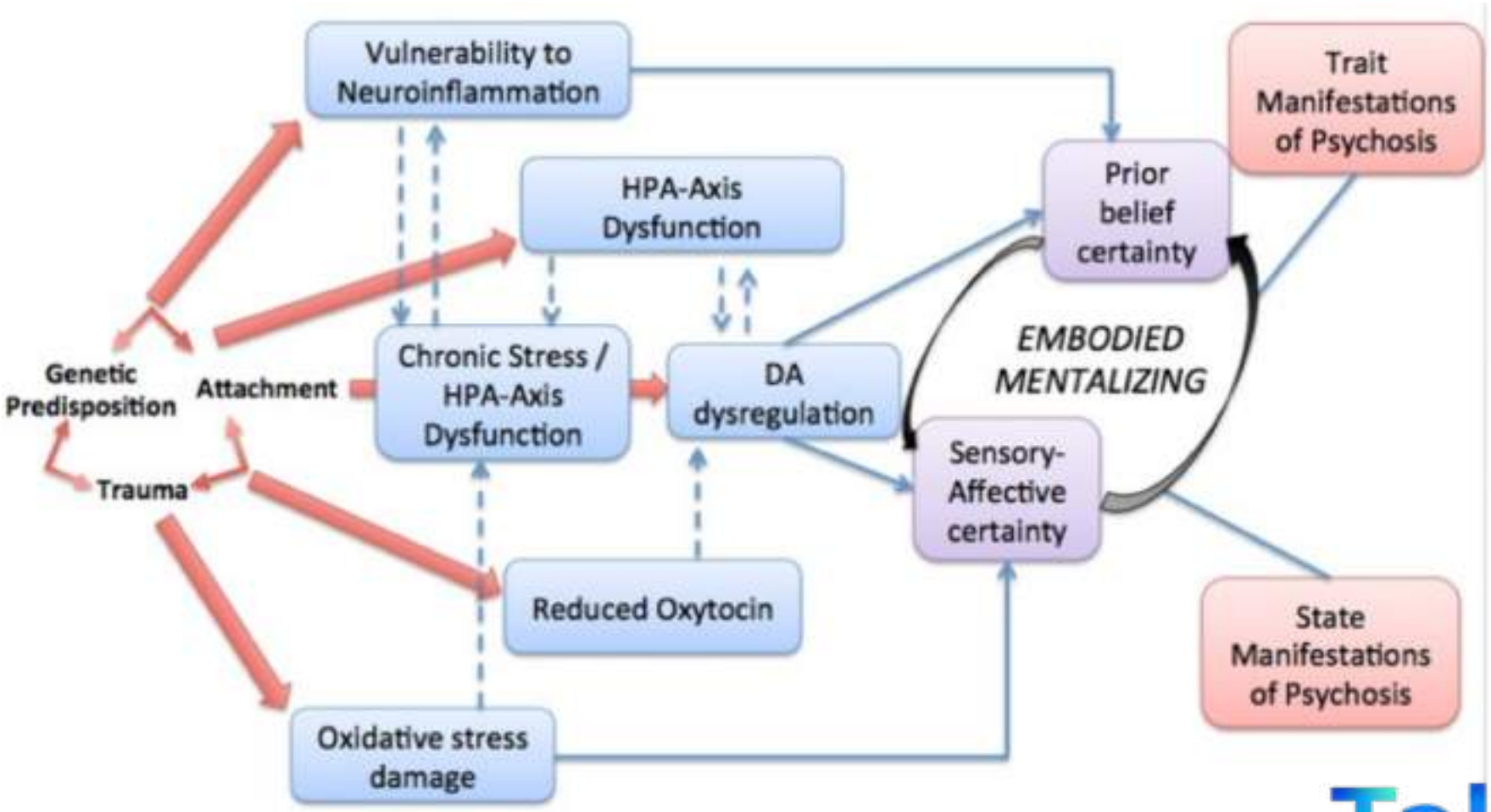
Jorge Bucay: Amarse con los ojos abiertos, 2010

Organización funcional



Entre más te OPONGAS más te OBSESIONA

Síndrome Romeo-Julieta.



J Neuroendocrinol. 2011 23(11):1054-65. Maternal neglect: oxytocin, dopamine and the neurobiology of attachment.
Strathearn L1.

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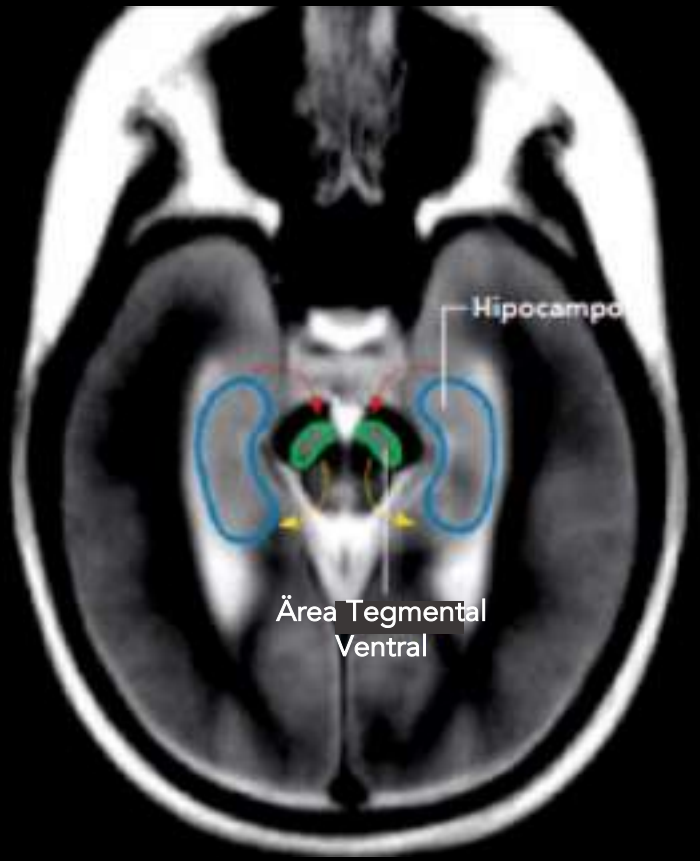
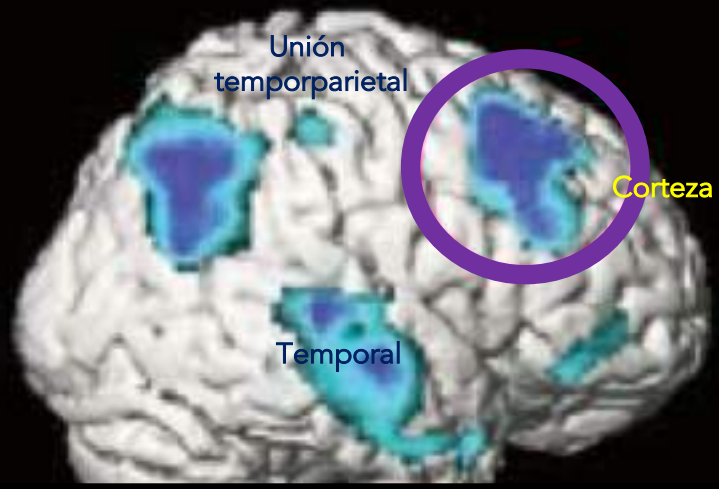
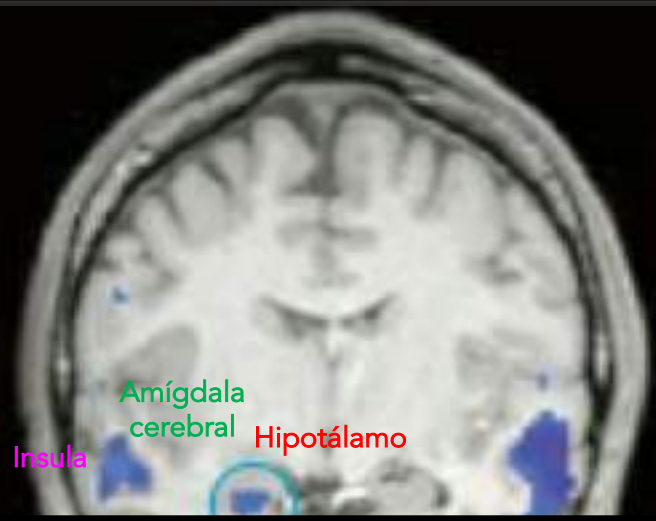
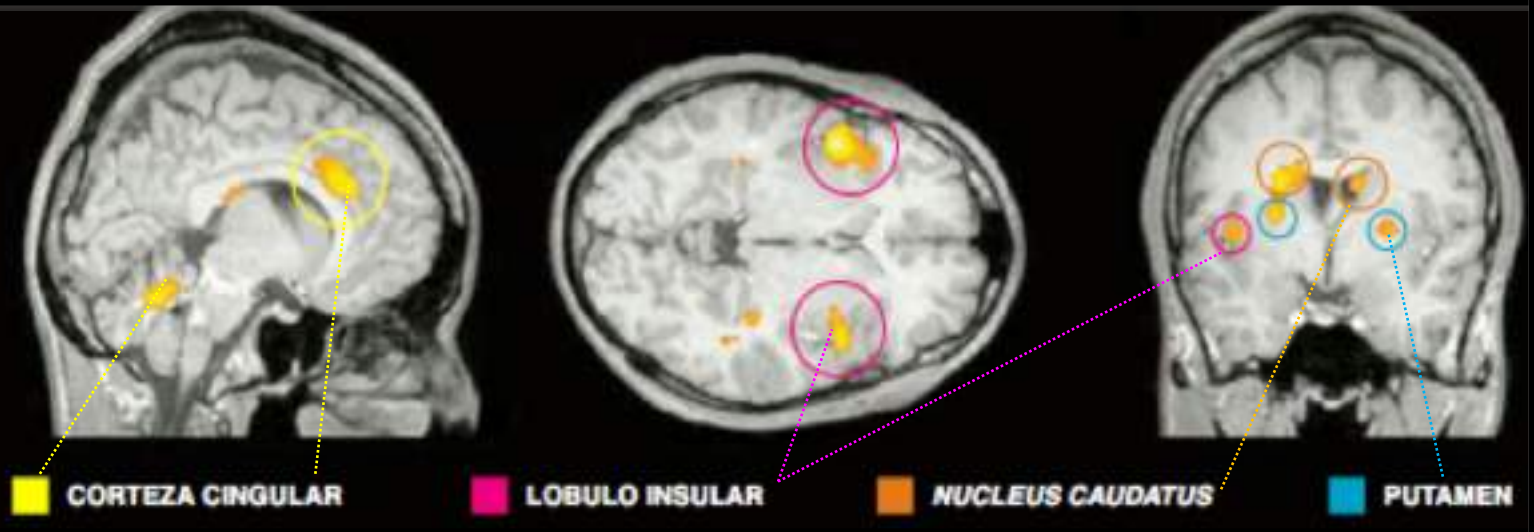
by UCIC

¿En dónde esta el amor?









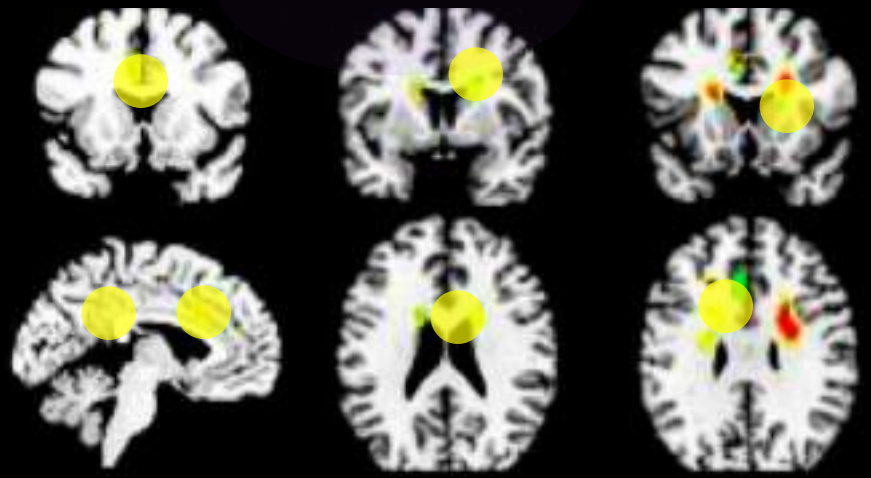
Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

El tiempo, el amor y la vida…

Enamoramiento

29 áreas









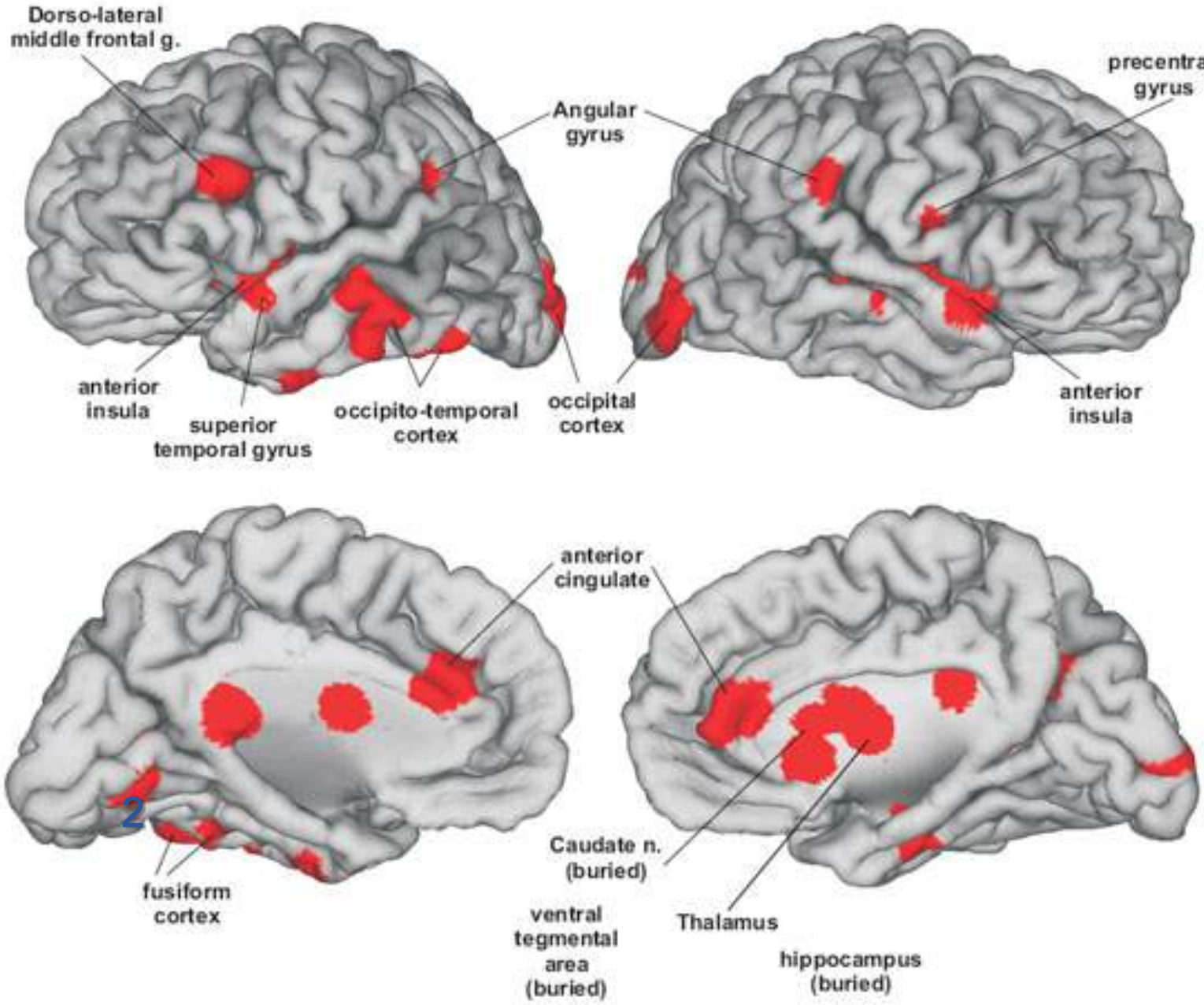
AMOR

15 áreas

Neuroanatomía

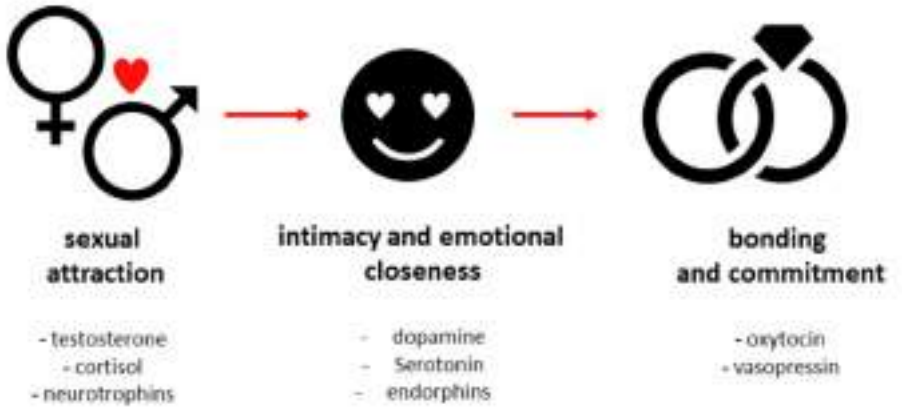


1. Corteza pre-frontal 2
2. Corteza orbito-frontal
3. Giro precentral
4. Corteza Insular
5. Unión temporo-parietal
6. Cíngulo
7. Bulbo olfatorio
8. Amígdala
9. Hipotálamo Lateral
10. Área Tegmental Ventral
11. Núcleo Caudado
12. Giro del Cíngulo
13. Hipocampo
14. Ganglios Basales
15. Área periacueductal
16. Corteza fusiforme



Bartels A; Zeki S. The Neural correlates of maternal and romantic love. *Neuroimage. 2004; 21 1155-1166*

lenguaje universalmente comprendido



Love-Related Molecule	Psychological Effect	Brain Region	Receptor/Interacting Molecule
NGF, BDNF (peptides)	Social interaction, anxiety, behavioral, and emotional modifications	Hippocampus, hypothalamus, cortex	p75NTR TrkA, TrkB, TrkC
Cortisol (steroid)	Decision making, arousal, initiation of contact, response to stress	Amygdala, hippocampus, and prefrontal cortex, brainstem nuclei	GR-NR3C1 MR
Serotonin (monoamine)	Emotions and feelings processing, stalking and obsessive component of romantic love, preoccupation, anticipation, mood regulations	The raphe nuclei in brain stem, projection sites to the hippocampus, amygdala, and cortex.	5-HT1, 2, 4 G coupled receptor 5-HT3 receptor a ligand gated ion channel
Dopamine (monoamine)	Desire, reward, sensation seeking, motivated behavior, feelings of pleasure, mate preference, expectation, representation of goals, and integration of sensory inputs	The substantia nigra pars compacta and the ventral tegmental area, projections make up the nigrostriatal, mesocortical and mesolimbic pathways	D1–D5 G coupled receptors
Endorphins (peptides)	States of pleasure, sex, love, motivational and pre-mating stages of sexual behavior, enhance well-being	Cerebral cortex, brainstem, caudate nucleus, thalamus-midbrain, hippocampus, amygdala	Mu-receptors-primarily delta-receptors, kappa-receptors, nociceptin receptors
Testosterone (steroid)	Emotional recognition and expression	Amygdala, inferior frontal gyrus	AR-NR3C4
	Response to sexual stimuli	Hippocampus, frontal gyrus	
	Decision making	Orbitofrontal cortex	
	Facial expressions	Hippocampus, amygdala	
Oxytocin, vasopressin (peptides)	Empathy for facial expressions	Amygdala, insula	OR V1a, V1b V2 (not in brain) G coupled receptor
	Social attachment, mating strategies towards monogamy, appreciation and gratitude of the partner	Prefrontal cortex, left and right precuneus, nucleus accumbens, amygdala, prelimbic cortex	
	Trust, trustworthiness	Amygdala, midbrain, dorsal striatum, insula	
	Subjective feelings	Insula	
	Emotional patch	Anterior cingulate cortex, anterior insula	
	Compensatory adjustments in cognitive control	Anterior cingulate cortex	
	States of happiness, interoception	Anterior cingulate cortex	
	Social interactions that involve assessing of emotions	Anterior cingulate cortex	
	Pleasurable feelings and pair-bonding	Ventral tegmental area	

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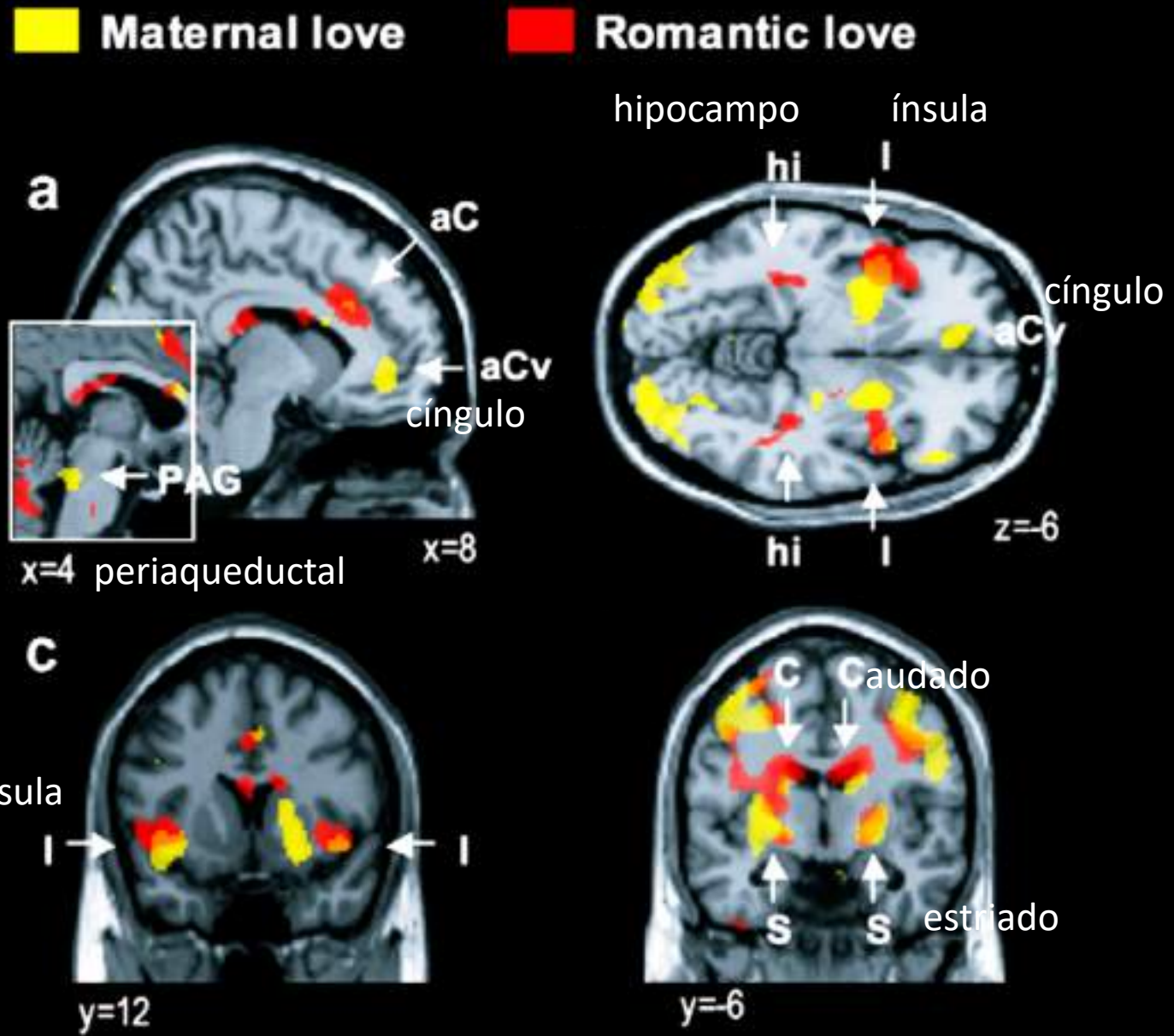






Medial temporal

temporal

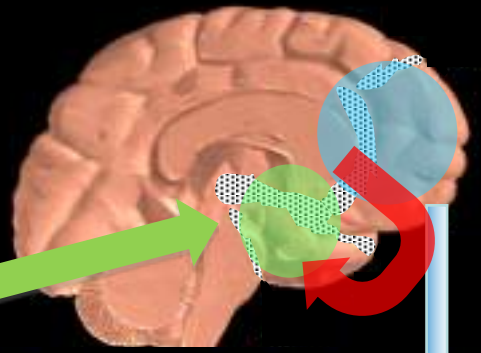
Fuente: Beauregard, M. et al., Journal of Neuroscience. 2001. 21: RC165.

En adultos, la auto-regulación emocional es normalmente llevada a cabo por el circuito neural entre:

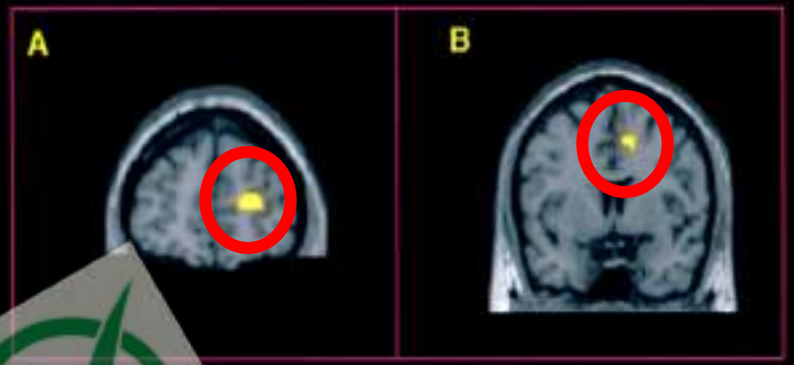
La región Prefrontal y el sistema límbico

Condición de deseo Sexual





Proceso de inhibición



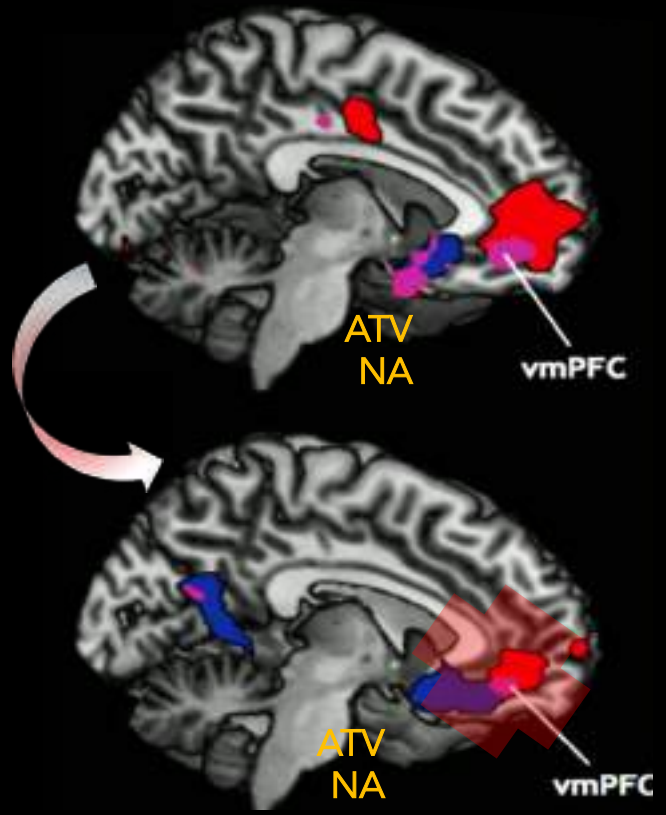
Condición inhibida

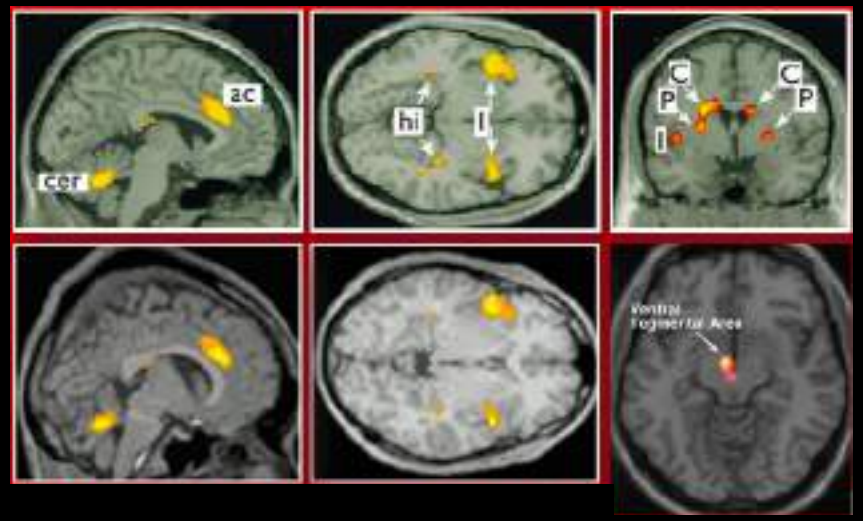


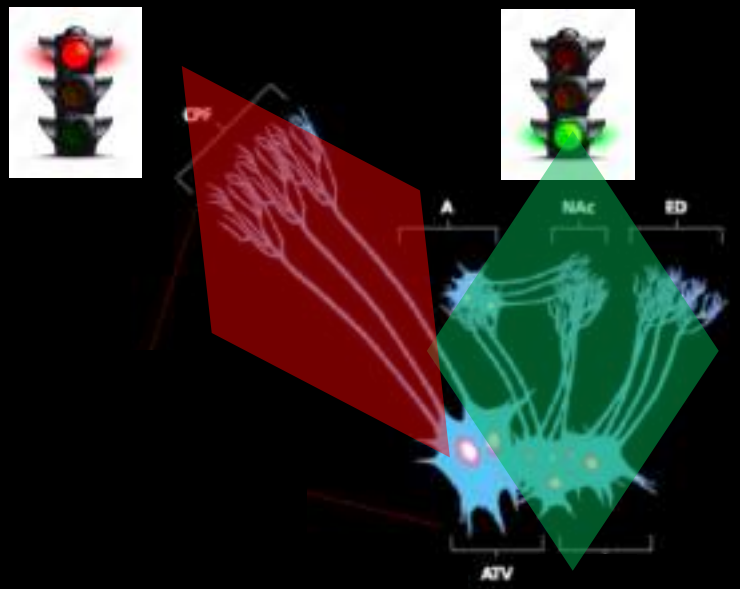


Fuente: Beauregard, M. et al., Journal of Neuroscience. 2001. 21: RC165.

Sin corteza prefrontal… pero con gran actividad del sistema límbico





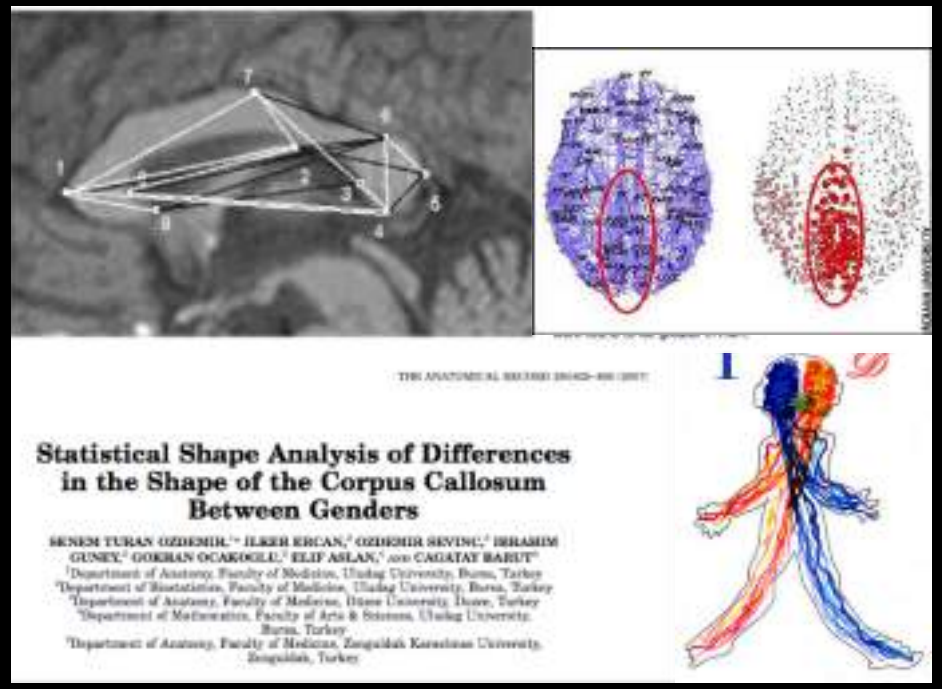


ATV 35 a 75% más grande en el cerebro de la mujer



The Neurobiology of Love and Pair Bonding from Human and Animal Perspectives
Blumenthal, Young.
Biology 2023, 12, 844. https://doi.org/10.3390/biology12060844
https://www.mdpi.com/journal/biology

Cuerpo calloso

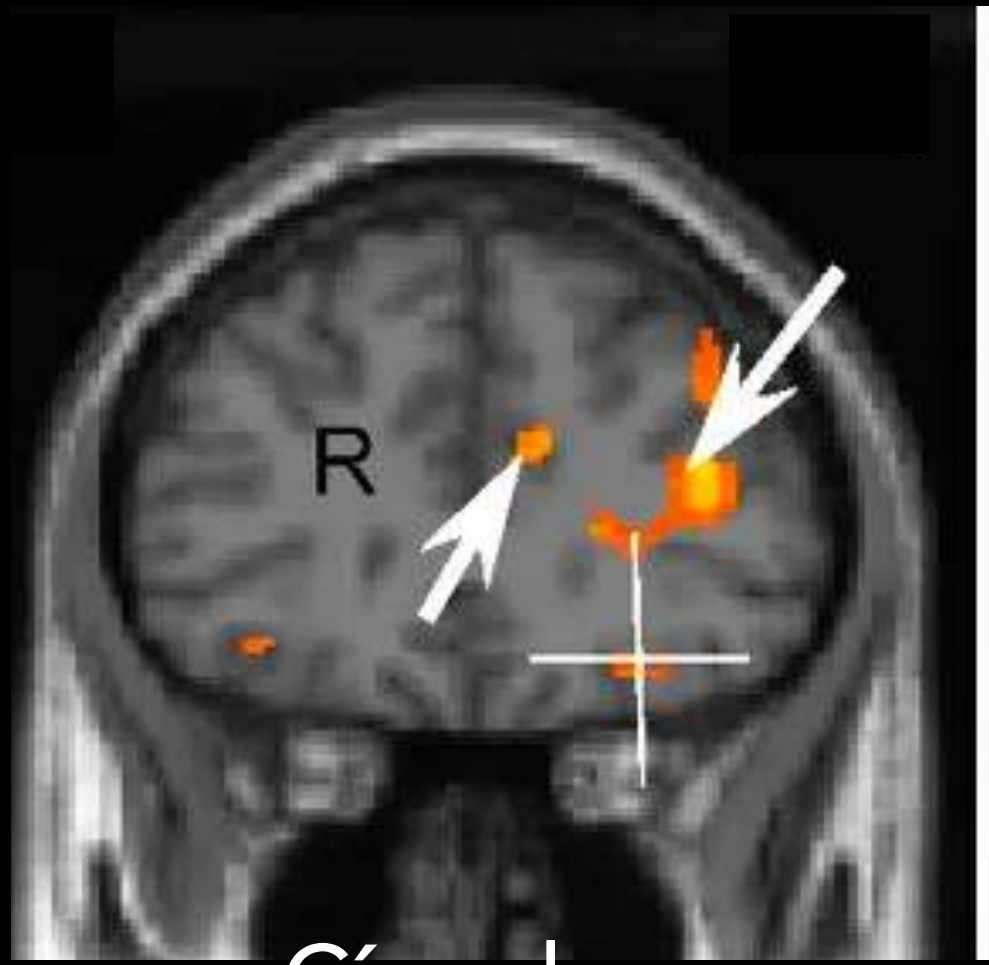


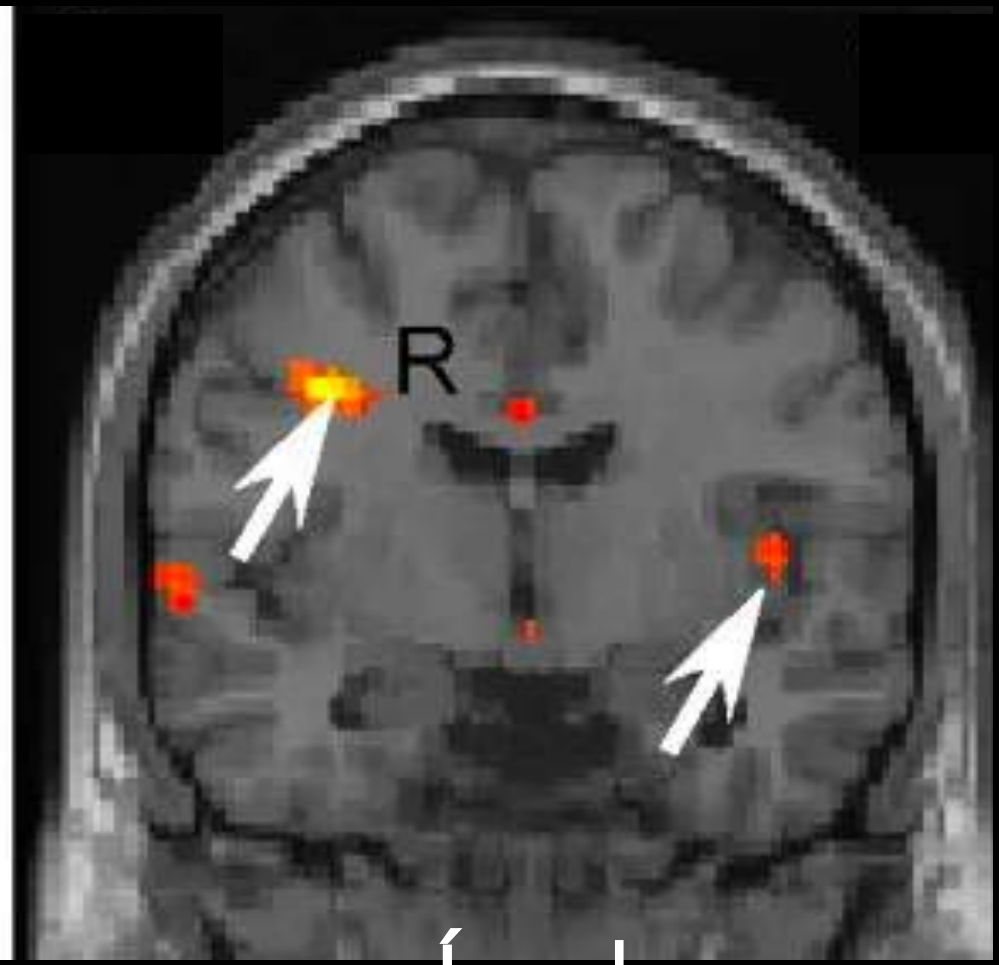
Statistical Shape Analysis of Differences in the Shape of the Corpus Callosum Between Genders

SENEM TURAN OZDEMIR,[1]* ILKER ERCAN,[2] OZDEMIR SEVINC,[3] IBRAHIM GUNEY,[4] GOKHAN OCAKOGLU,[5] ELIF ASLAN,[1] AND CAGATAY BARUT[6]
[1]Department of Anatomy, Faculty of Medicine, Uludag University, Bursa, Turkey
[2]Department of Biostatistics, Faculty of Medicine, Uludag University, Bursa, Turkey
[3]Department of Anatomy, Faculty of Medicine, Dicle University, Diyarbakir, Turkey
[4]Department of Mathematics, Faculty of Arts & Sciences, Uludag University, Bursa, Turkey
[5]Department of Anatomy, Faculty of Medicine, Zonguldak Karaelmas University, Zonguldak, Turkey



El cuerpo calloso es 30% más grande en la mujer





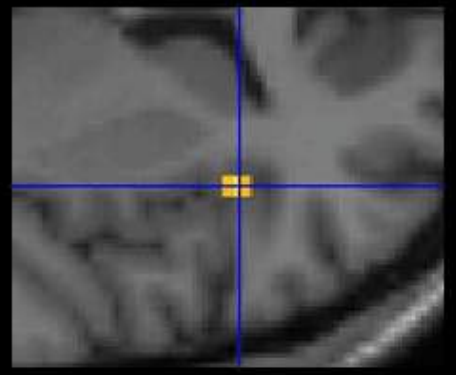
Cíngulo

Ínsula

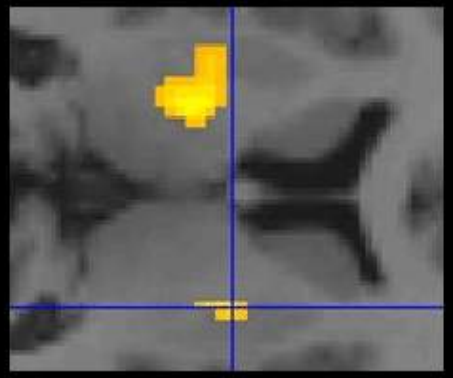

Neuroimage

Men and women are different: Diffusion tensor imaging reveals sexual dimorphism in the microstructure of the thalamus, corpus callosum and cingulum

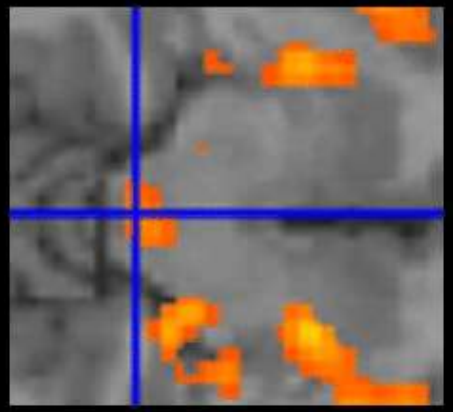
Mayor tamaño en las mujeres (20%)



Insula

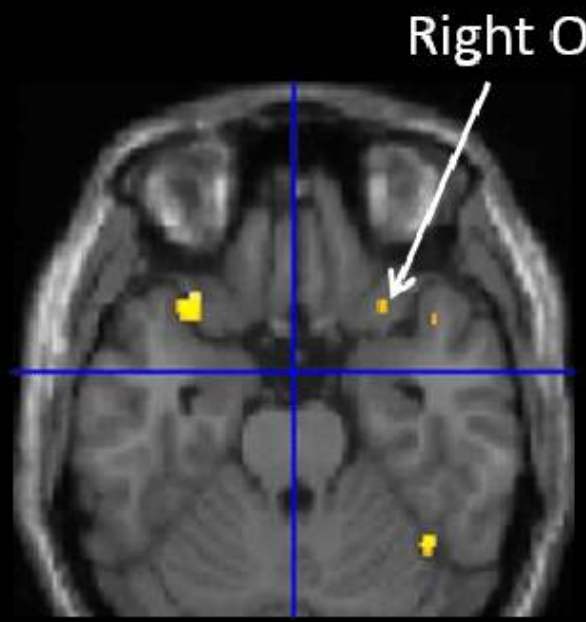


Striatum (putamen)

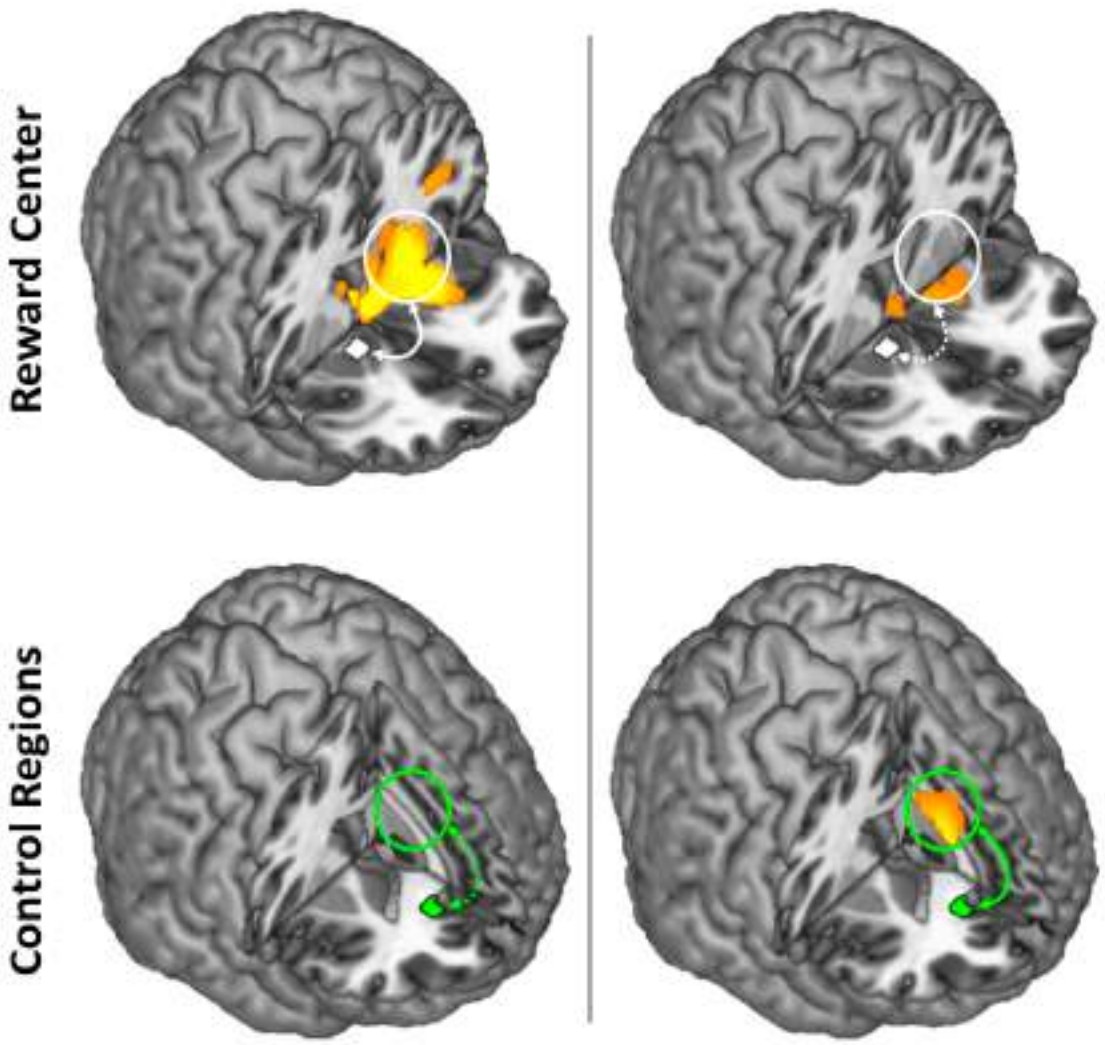


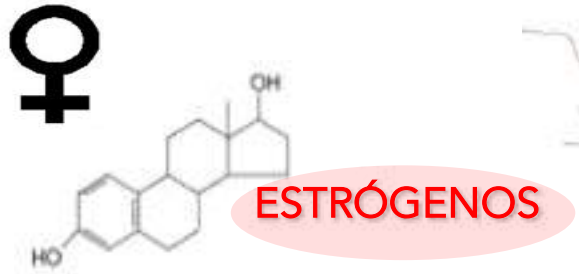
PAG

Una separación siempre enseña y capacita:
SUFRIR es una elección, genera cognición.

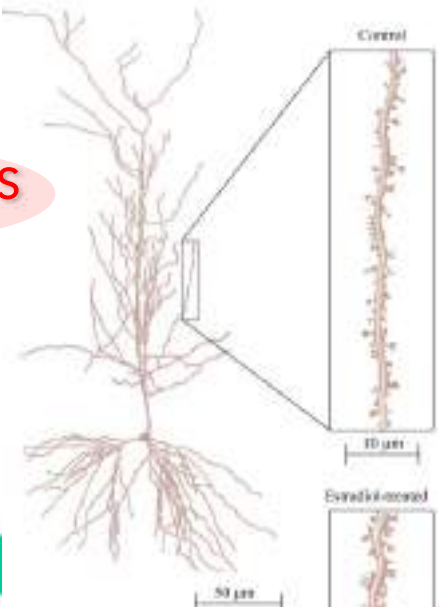


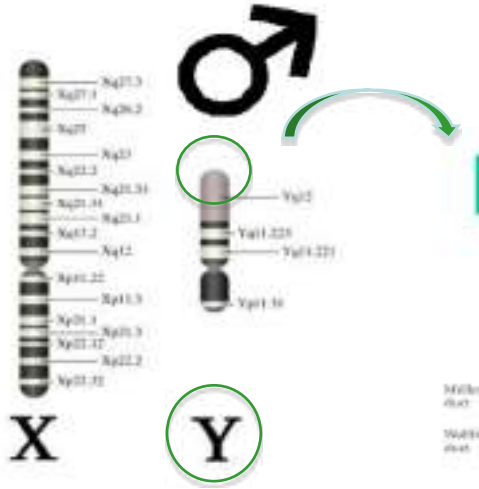
Brain Connectivity





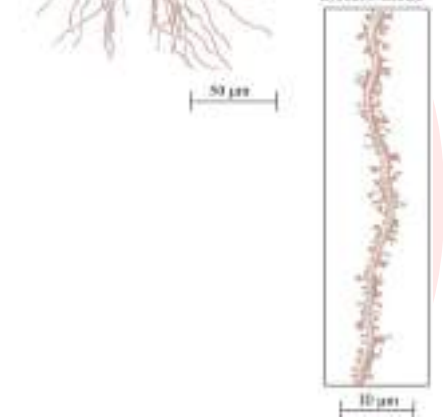
ESTRÓGENOS

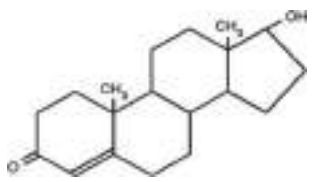




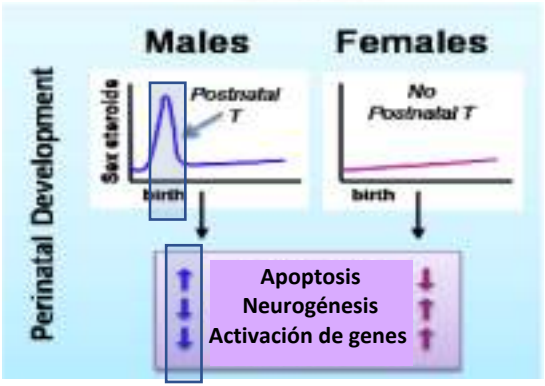
Sry (12 kb)

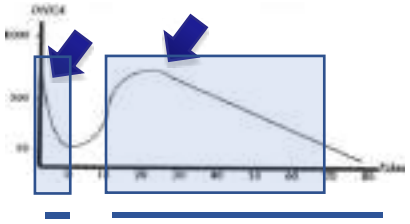






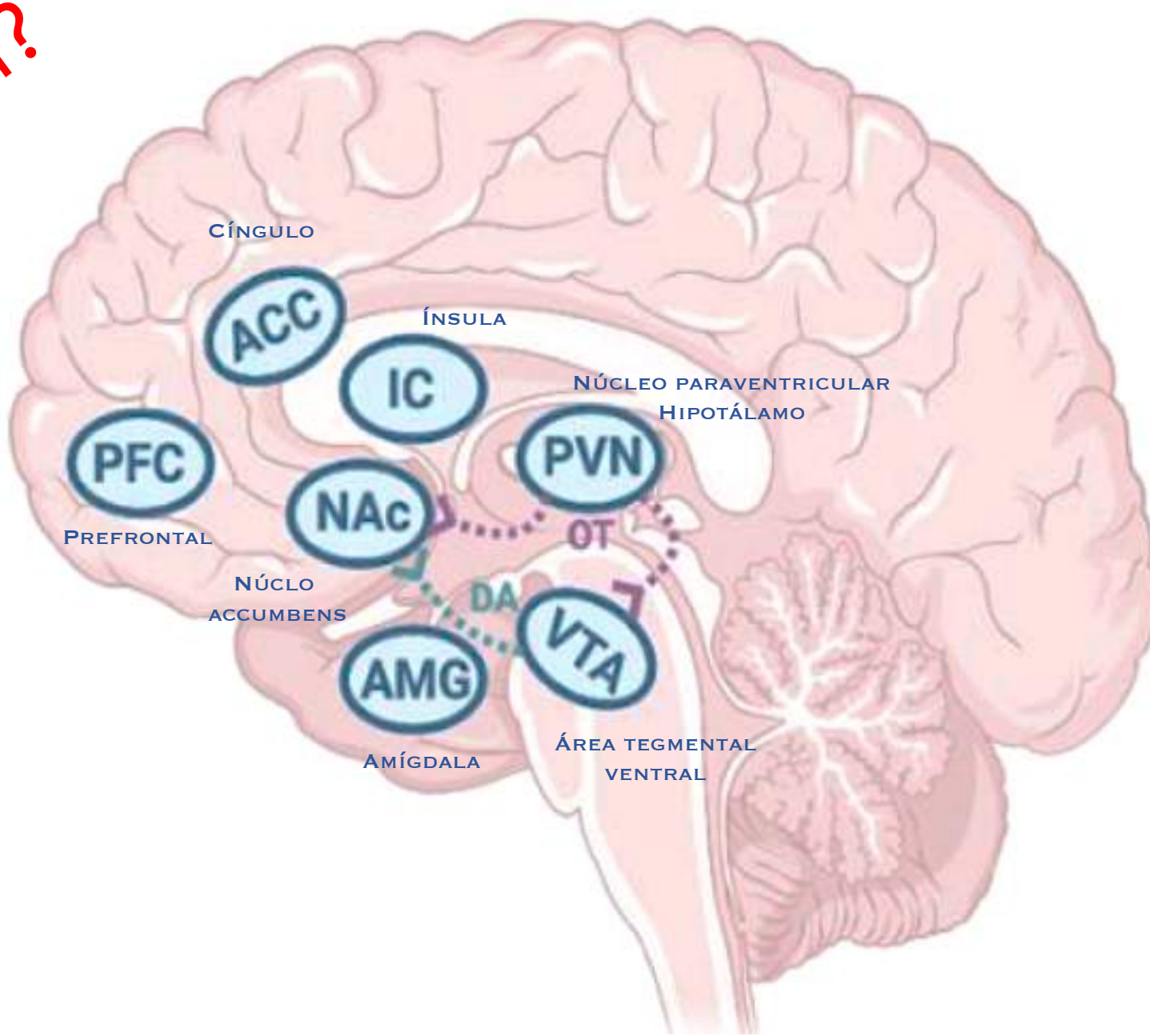
Testosterona





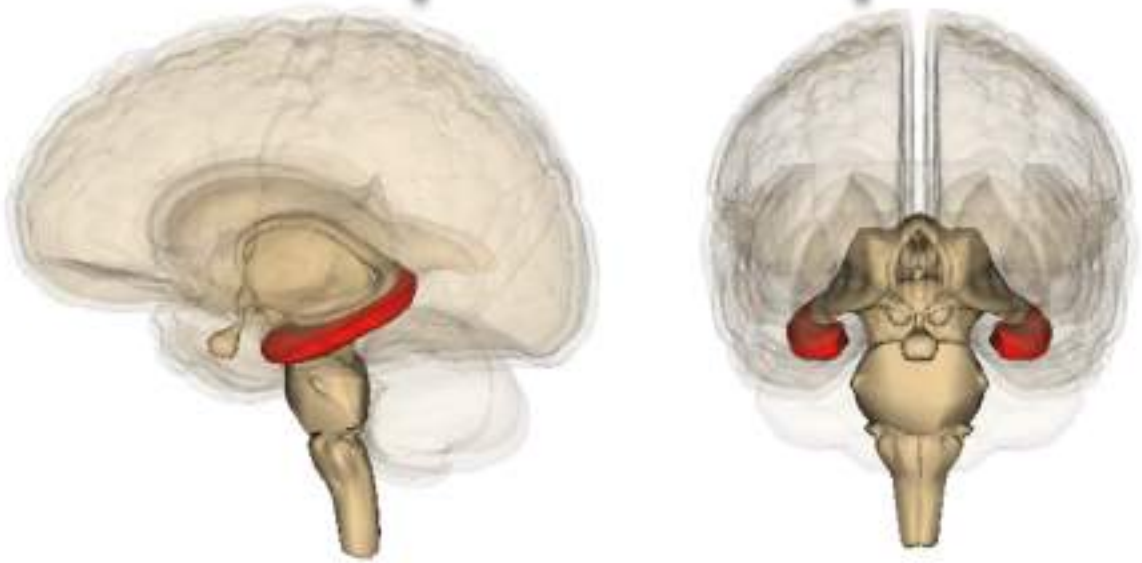
Testosterona

¿En dónde esta la pasión?



The Neurobiology of Love and Pair Bonding from Human and Animal Perspectives
Blumenthal, Young.
Biology 2023, 12, 844. https://doi.org/10.3390/biology12060844
https://www.mdpi.com/journal/biology

Hipocampo



Mayor tamaño en las **mujeres** (15 -25 %)



Brain Cogn. 2010 February ; 72(1): 46. doi:10.1016/j.bandc.2009.10.008.

Sex differences in the adolescent brain

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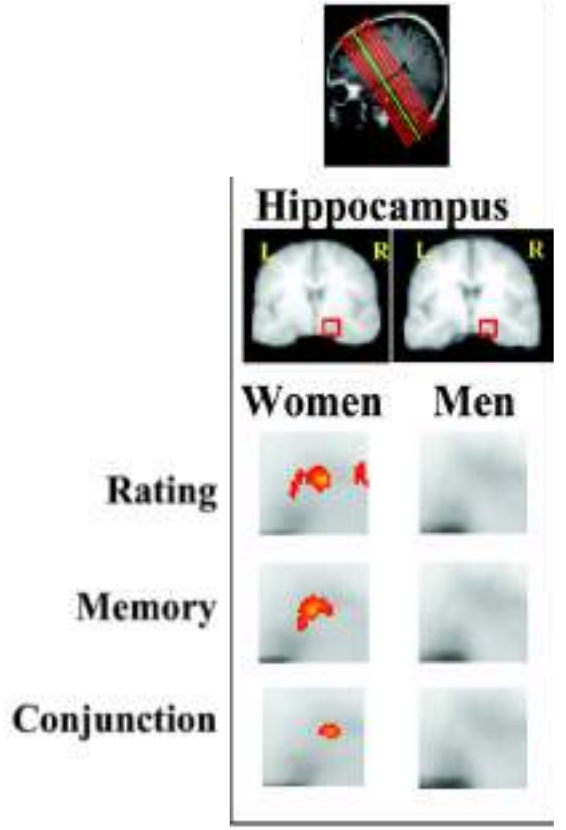
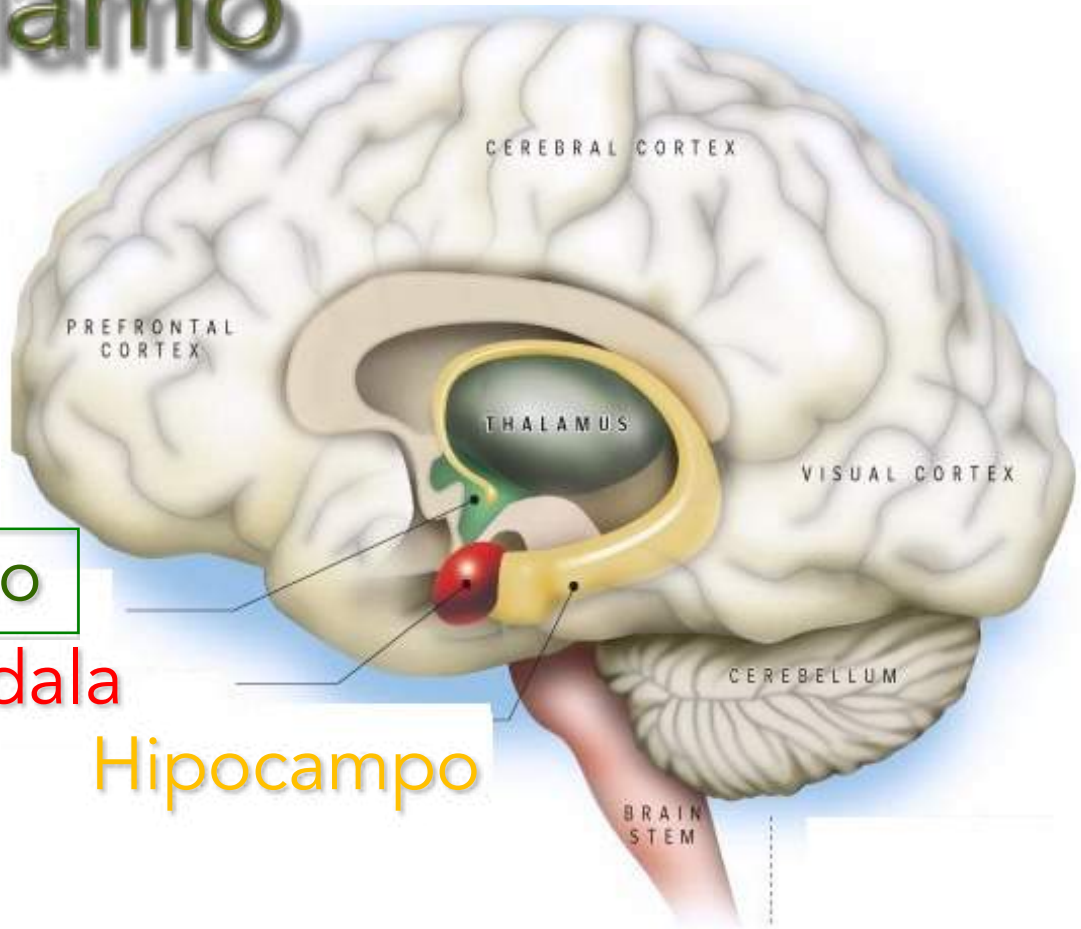
[1] Department of Psychiatry, University of New South Wales, Sydney, NSW Australia
[2] Child Psychiatry Branch, Brain Imaging Unit, National Institute of Mental Health, National Institutes of Health, Bethesda, MD USA



Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

Hipotálamo



Hipotálamo

Amígdala

Hipocampo

NeuroImage

Men and women are different: Diffusion tensor imaging reveals sexual dimorphism in the microstructure of the thalamus, corpus callosum and cingulum

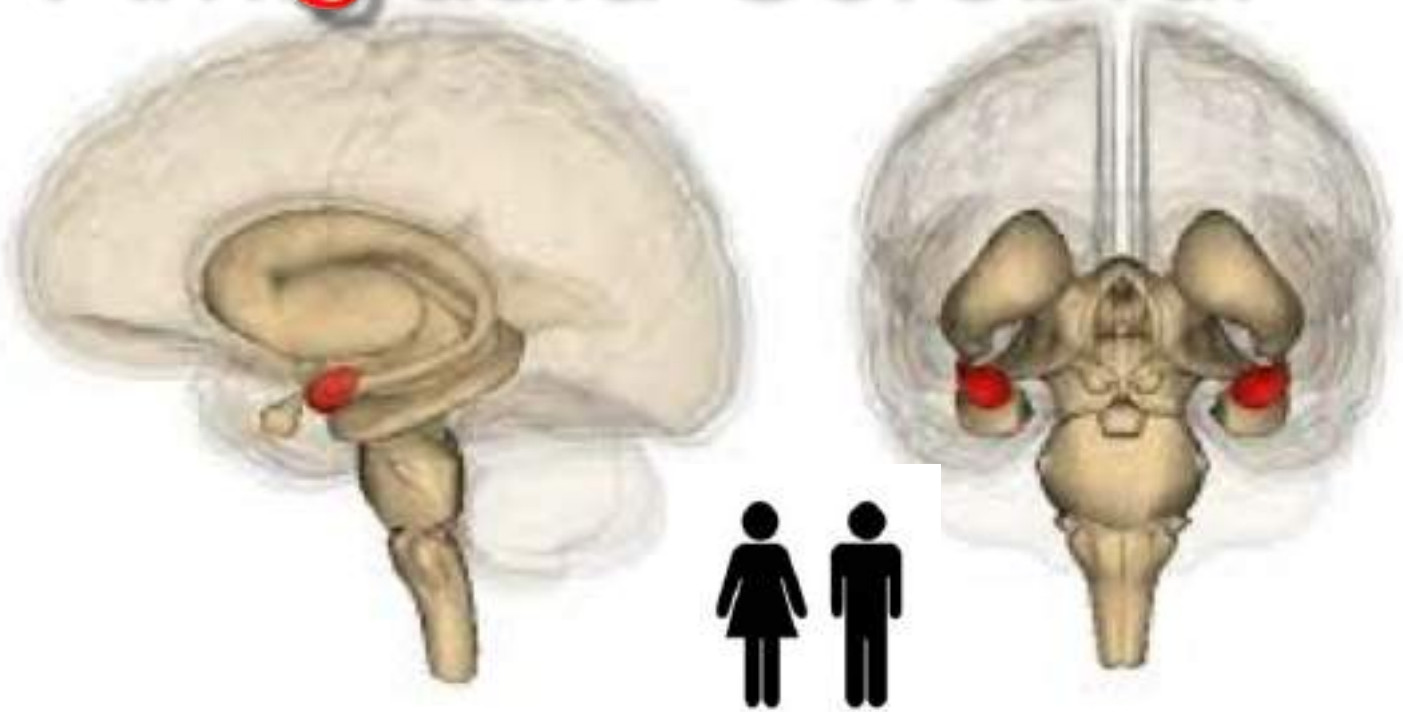
K. Menzler, M. Belke, E. Wehrmann, K. Krakow, U. Lengler, A. Jansen, H.M. Hamer, W.H. Oertel, F. Rosenow, S. Knake

RS 3-334

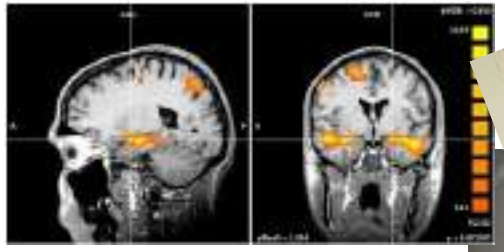
Mayor tamaño en los hombres (10-15%):
área pre-óptica (NIHA), Núcleo supraquiasmático y N. Ventro Medial.



Amígdala Cerebral



Mayor tamaño en los hombres (70-85%)

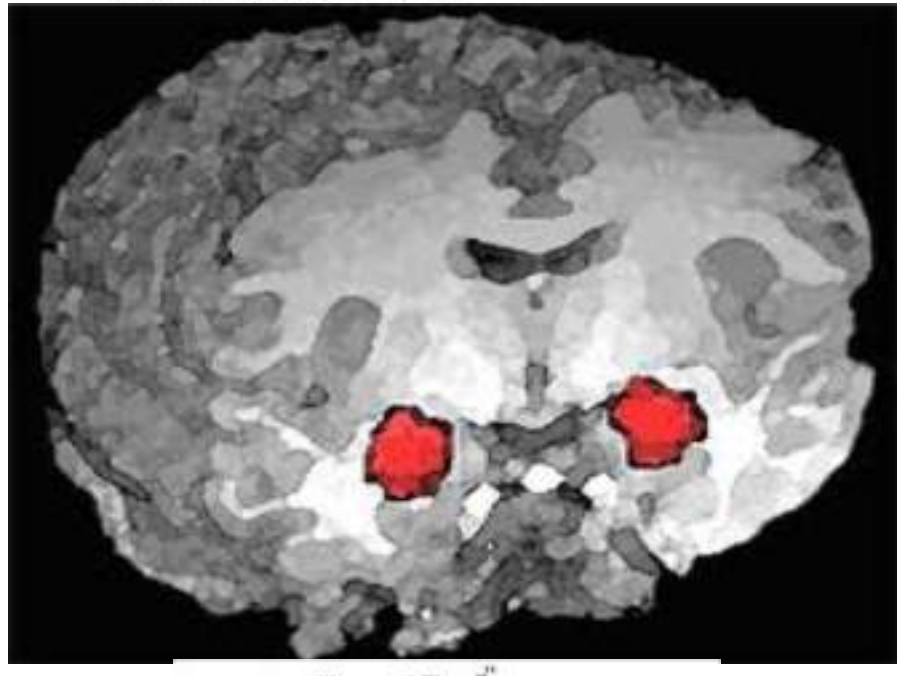


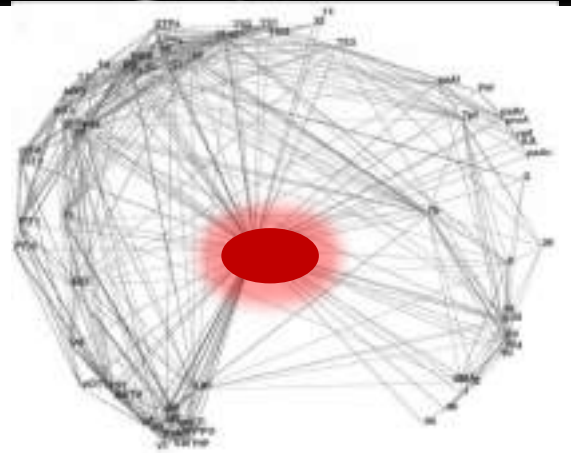


Decision-making in a Risk-taking Task:
A PET Study

Monique Ernst, M.D., Ph.D., Karen Bolla, Ph.D., Maria Mouratidis, M.A., Carlo Contoreggi, M.D., John A. Matochik, Ph.D., V. Kurian, M.S., M.H.S., Jean-Luc Cadet, M.D., Alane S. Kimes, Ph.D., and Edythe D. London, Ph.D.

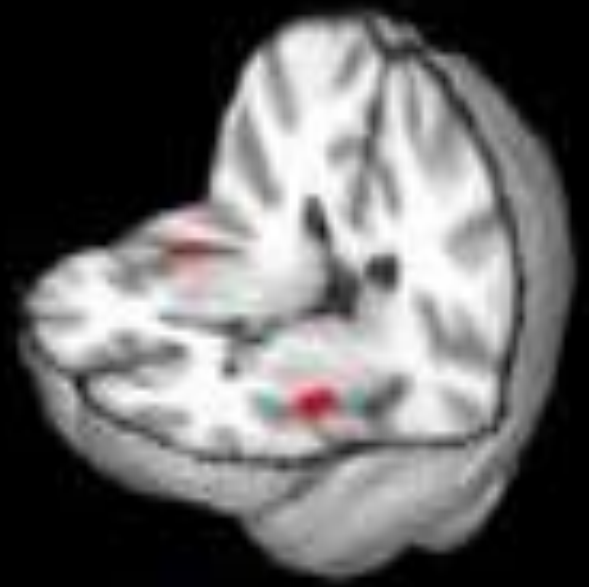
Neuropsychopharmacology 2002—Vol., No. 5
© 2002 American College of Neuropsychopharmacology
Published by Elsevier Science Inc.
655 Avenue of the Americas, New York, NY 10010





Amígdala izquierda

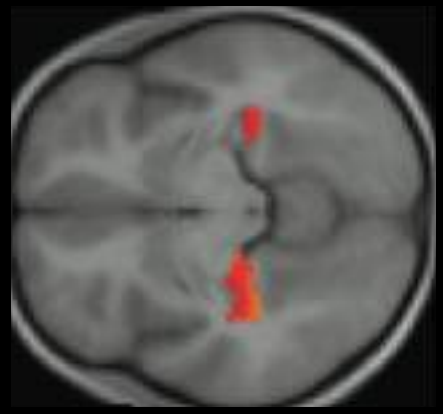


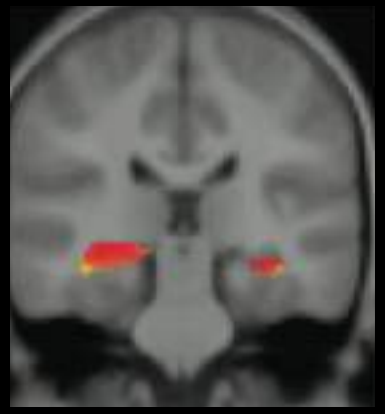


Cerebral Cortex February 2009;19:464–473
doi:10.1093/cercor/bhn100
Advance Access publication June 11, 2008

Sex Differences and the Impact of Steroid Hormones on the Developing Human Brain

Susanne Neufang[1,2,5,6], Karsten Specht[1,2,5], Markus Hausmann[6], Onur Güntürkün[7], Beate Herpertz-Dahlmann[8], Gereon R. Fink[1,2,9] and Kerstin Konrad[1,2,5]



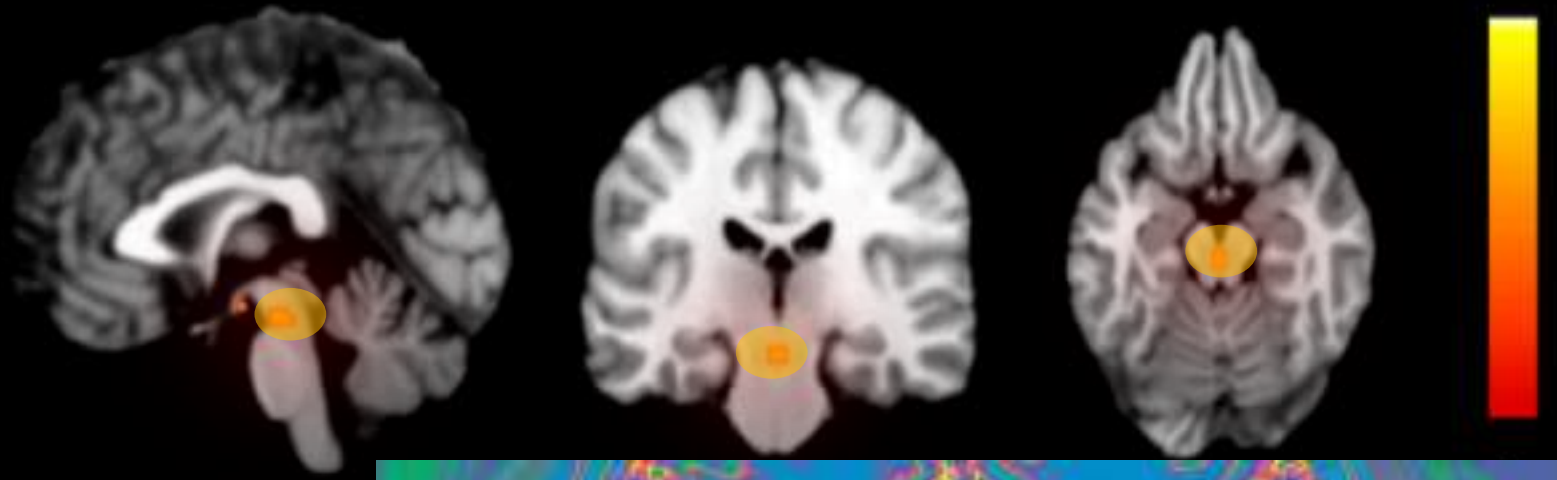


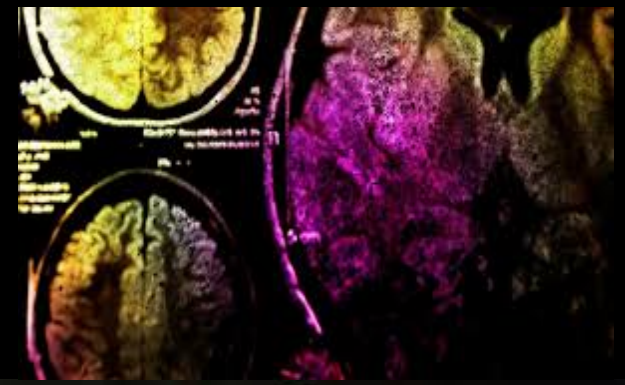


La actividad de la AI es mayor en las mujeres



Área Tegmental Ventral



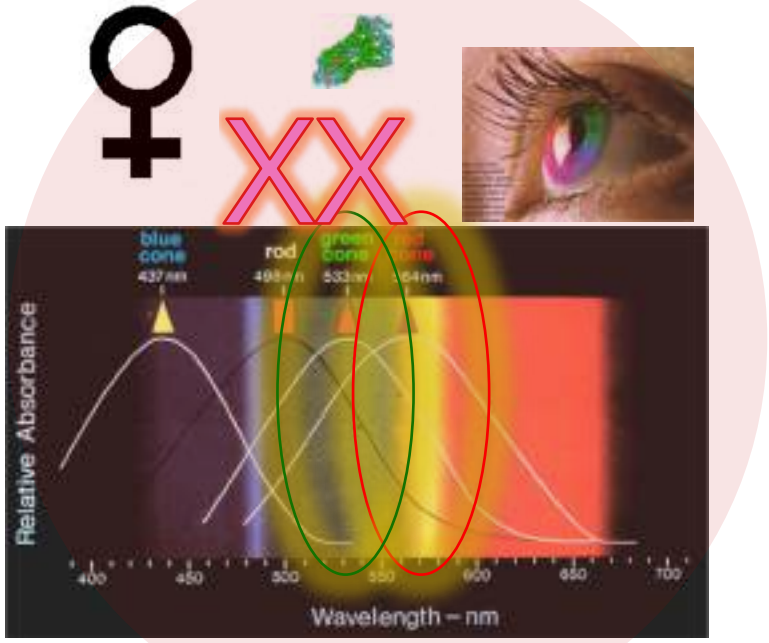


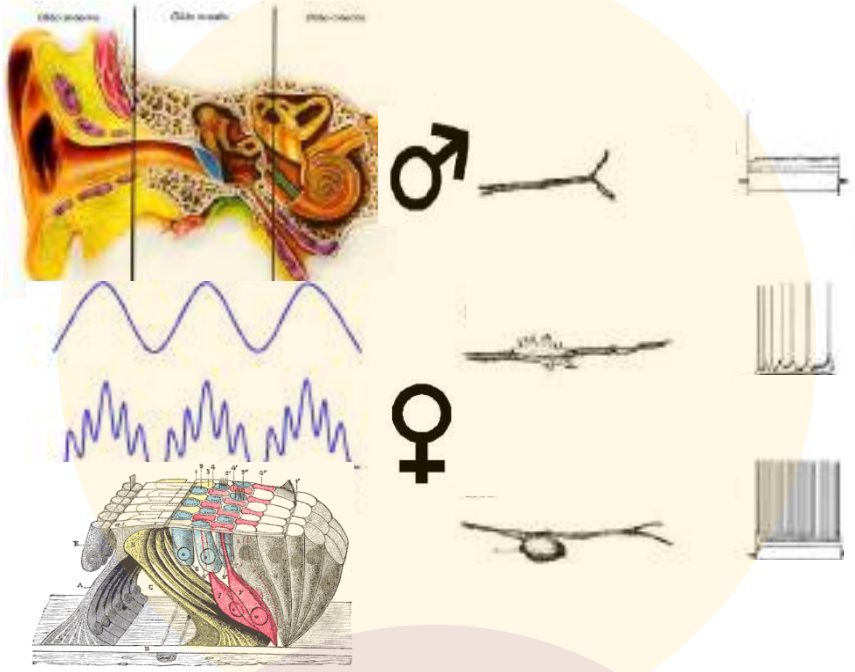


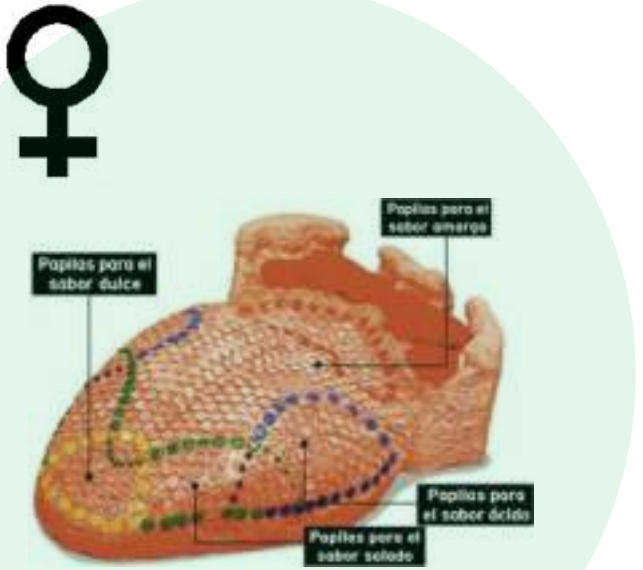


Mayor tamaño en las mujeres (75%)

The Neurobiological Basis of Love: A Meta-Analysis of Human Functional Neuroimaging Studies of Maternal and Passionate Love
Hsuan-Chu Shih et al
Brain Sci. 2022, 12, 830.
https://doi.org/10.3390/brainsci12070830
https://www.mdpi.com/journal/brainsci





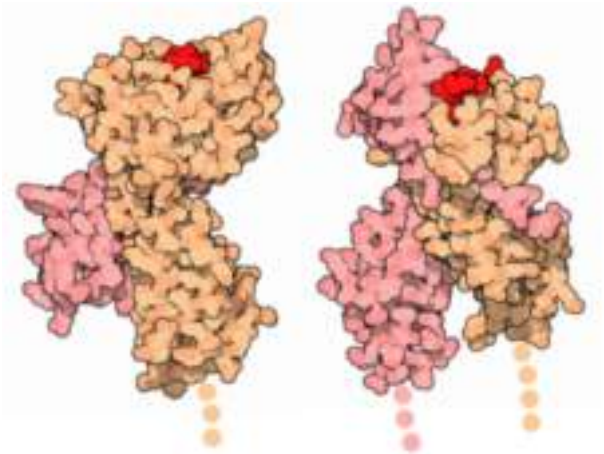


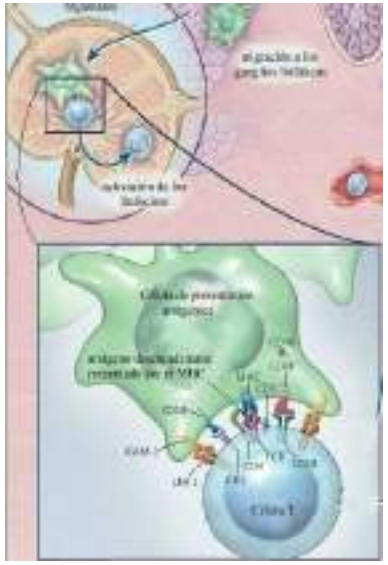


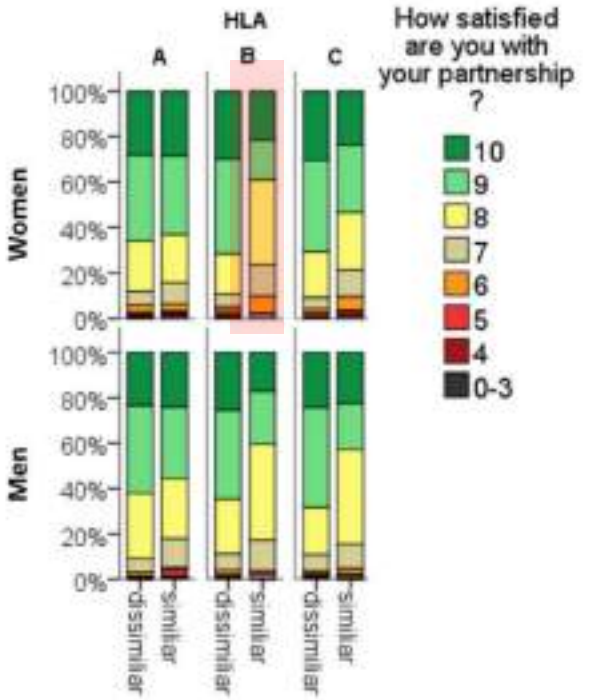
C. Koch. Regaining the rainbow. *Scientific American Mind, 2010; 3; 16-17*
Collignon O, et al. 2010 Women process multisensory emotion expressions more efficiently than men. Neuropsycologia 2010 48(1) 220-5
Seah S, Griffin M. Normal values for thermotactile and vibotactile thresold in male and females. Int Arch Occup Environ Health. 2008. 81(5) 535-43

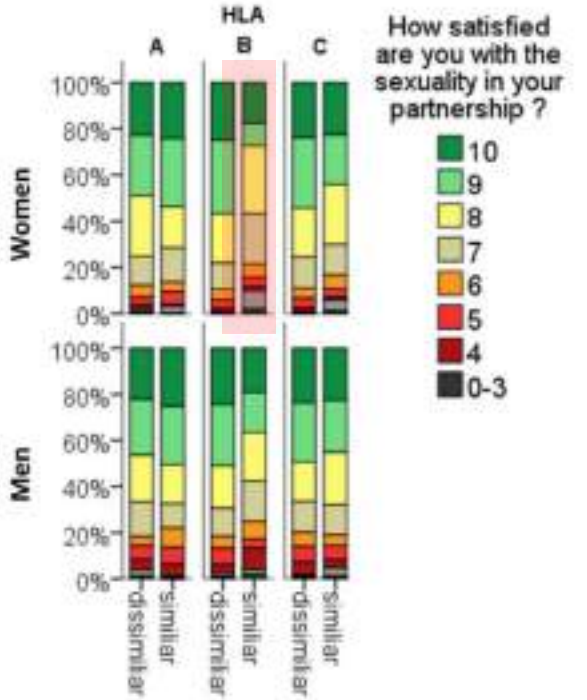
Complejo Mayor de Histocompatibilidad

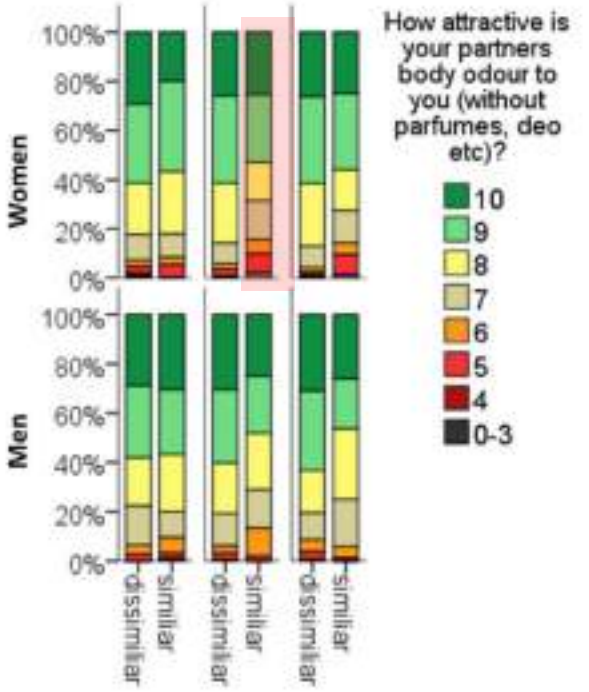
CMH

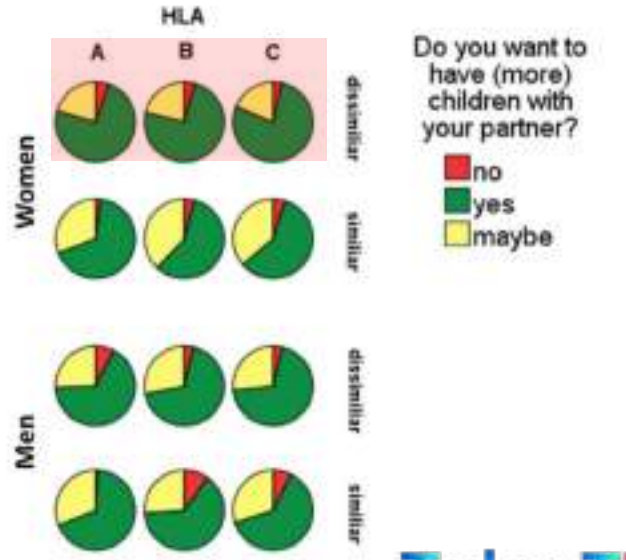












SCIENTIFIC REPORTS

OPEN Influence of HLA on human partnership and sexual satisfaction

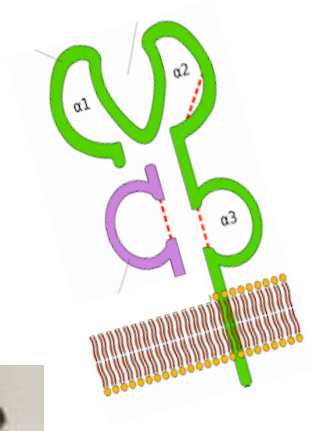
SCIENTIFIC REPORTS | 6:32550 | DOI: 10.1038/srep32550

TalenTU
by UCIC



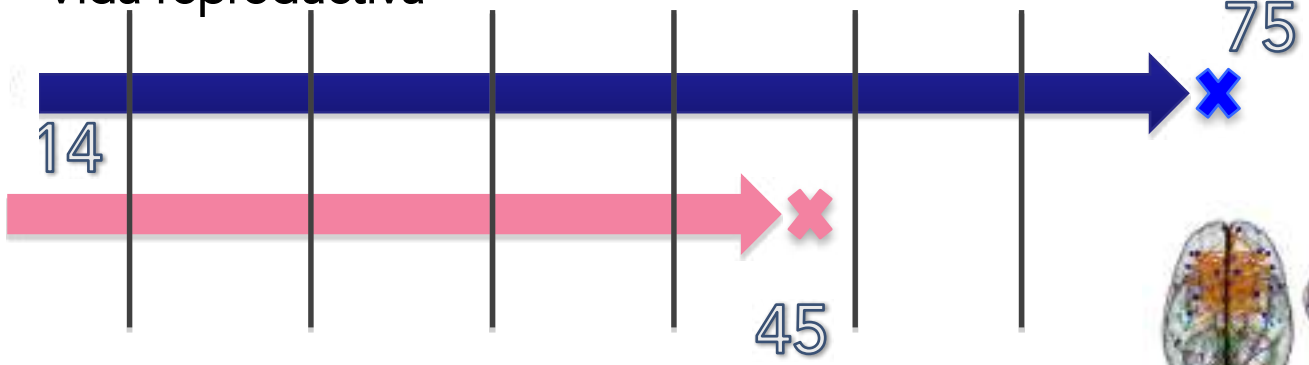
Complejo Mayor de Histocompatibilidad







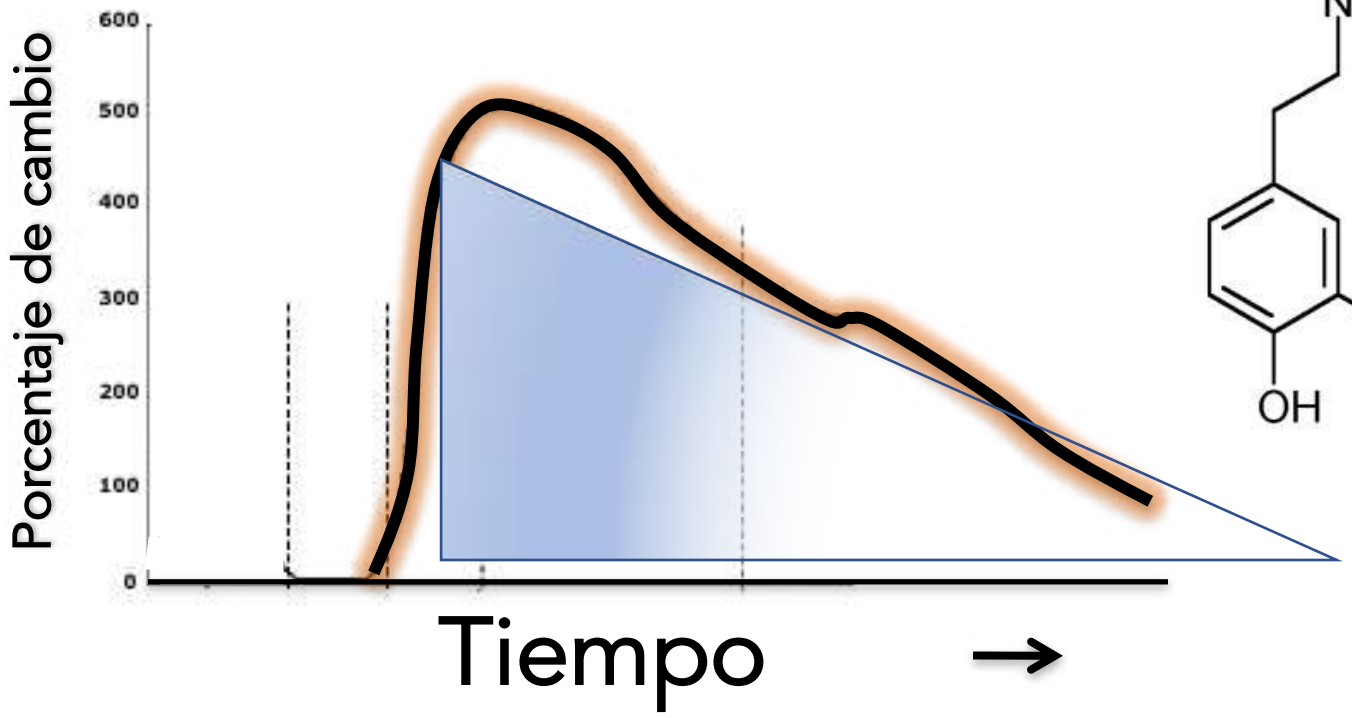
Vida reproductiva

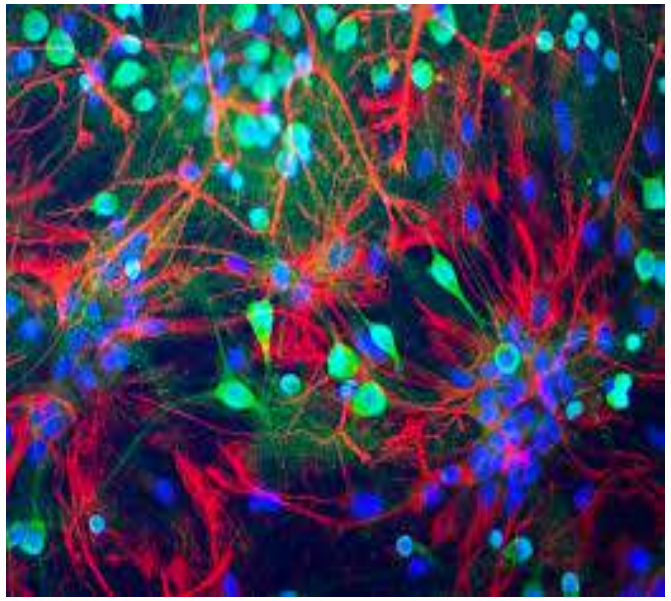




Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

La felicidad como las emociones son pasajeras, momentáneas.
Desensibilizan el sistema neuronal de percepción.



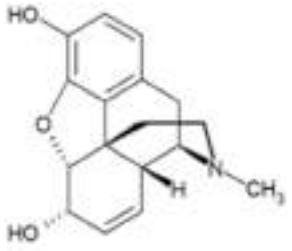


Dopamina

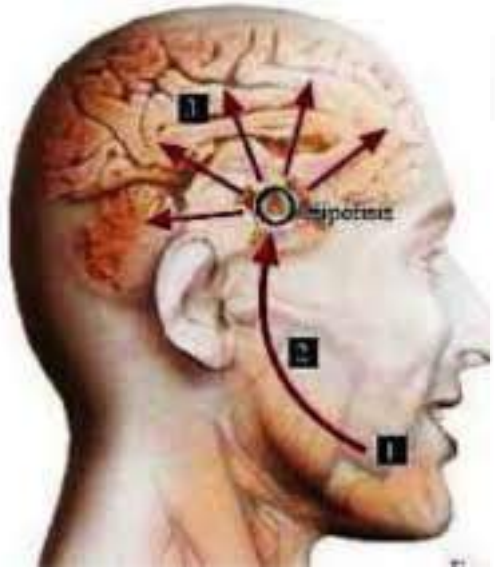
La intensidad de las emociones: DISMINUYE CON LA EDAD

Kröner S, Rosenkranz JA, Grace AA, Barrionuevo G. 2005 . Dopamine modulates excitability of basolateral amygdala neurons in vitroJ NeurophysiolMar;93(3):1598-610.

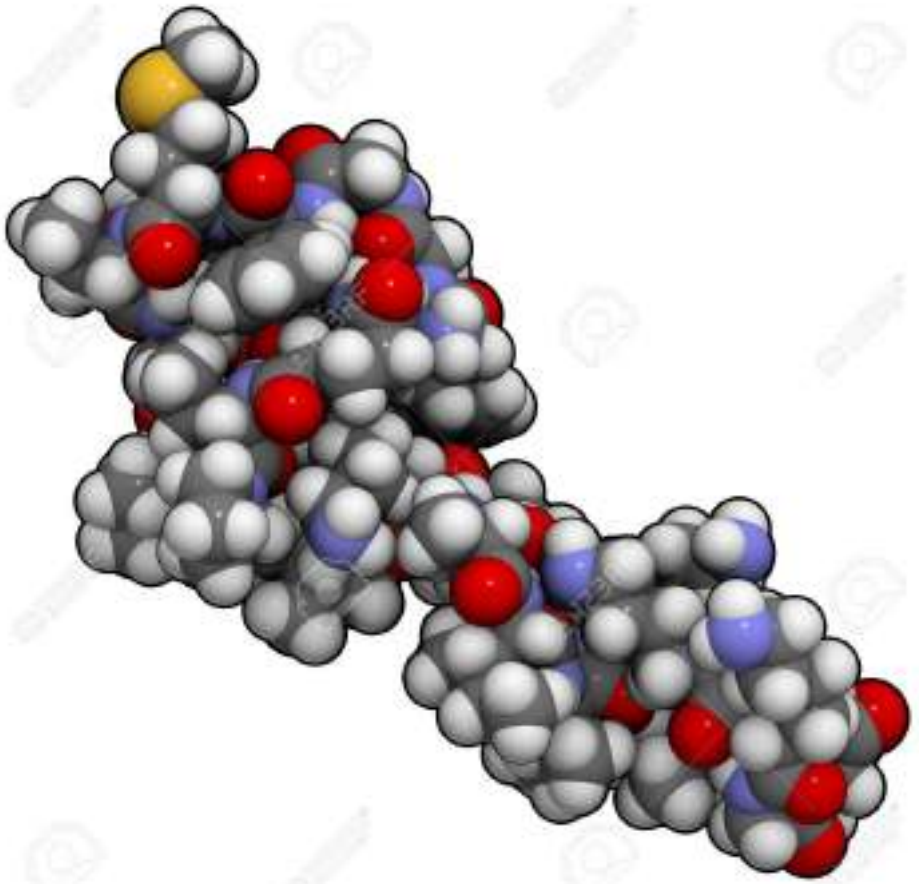
Endorfina



Endorfina



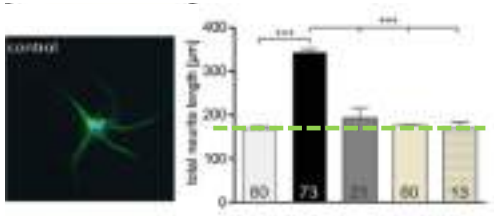


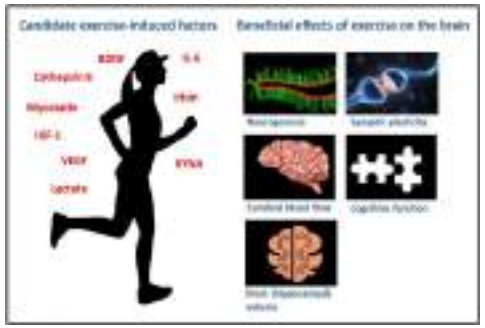


Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

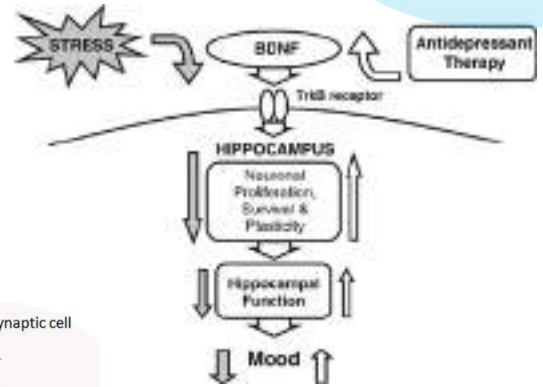
NEUROTROFINAS

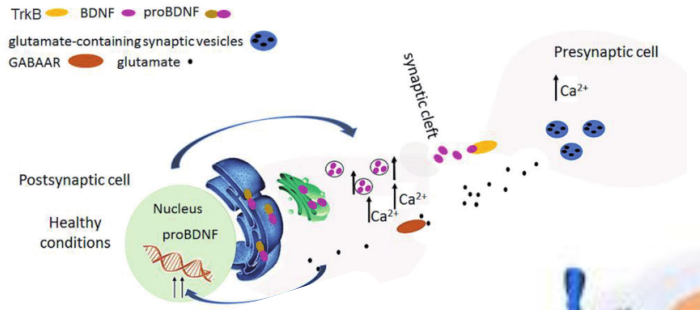
NGF / BDNF

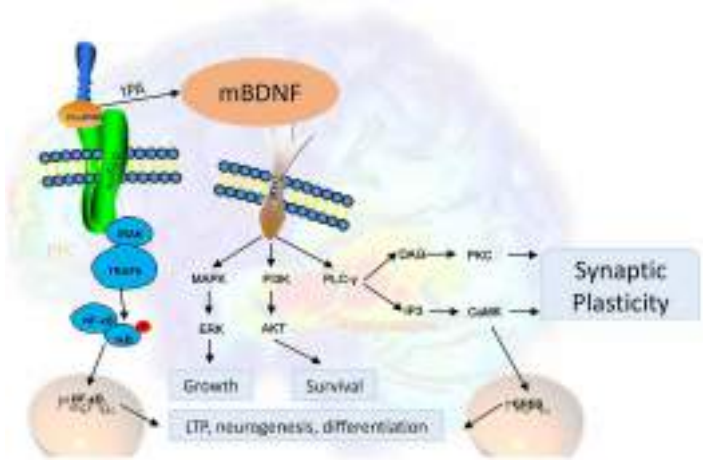












modula la actividad
de la hipófisis posterior: vasopresina/oxitocina

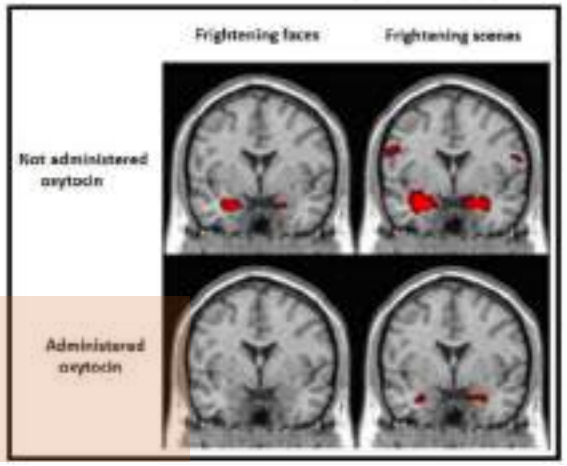
Tobias Esch; George Stefano. The Neurobiology of love. *Neuroendocrinol. Lett. 2005; 26 (3) 175-192*

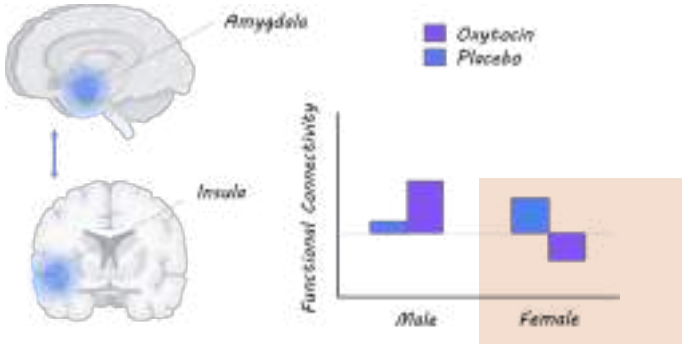
Oxitocina



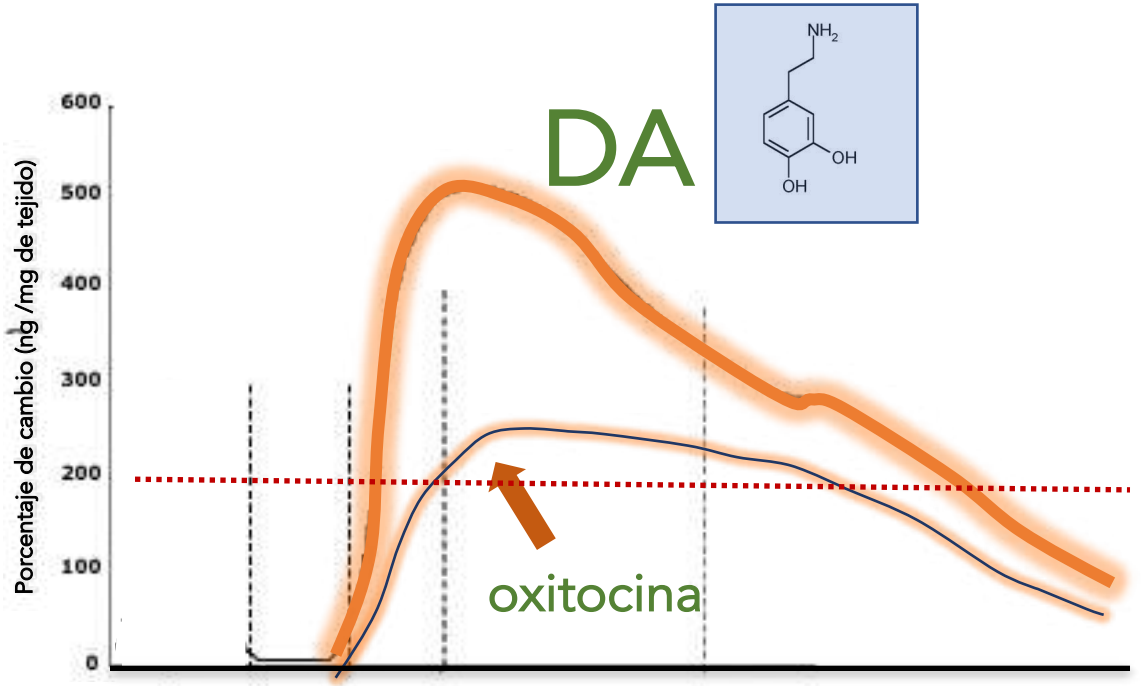
Apego, incremento del entorno social

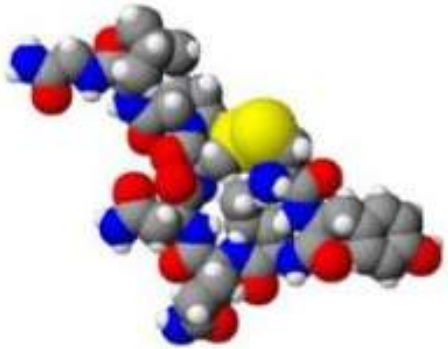
Oxytocin and Love:
Trust and Empathy





Neonatal Oxytocin Manipulations Have Long-Lasting, Sexually Dimorphic Effects on Vasopressin Receptors





Oxitocina = apego

De lo sublime al dolor



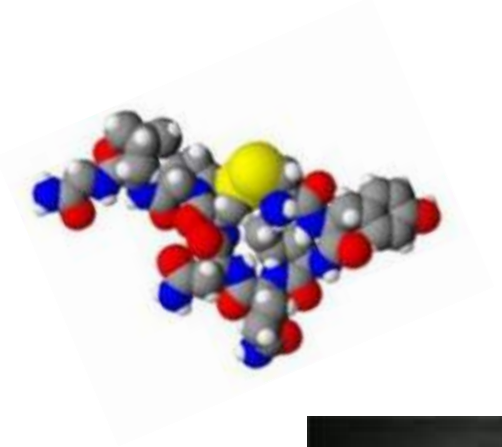
El que maltrata y abusa también hace liberar oxitocina y endorfinas en el cerebro.



Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

Síndrome de Estocolmo







Tobias Esch; George Stefano. The Neurobiology of love. *Neuroendocrinol. Lett. 2005; 26 (3) 175-192*

Kimura D. 2002. Sex differences in the brain. Scientific American 25:1-5.

De lo sublime al dolor

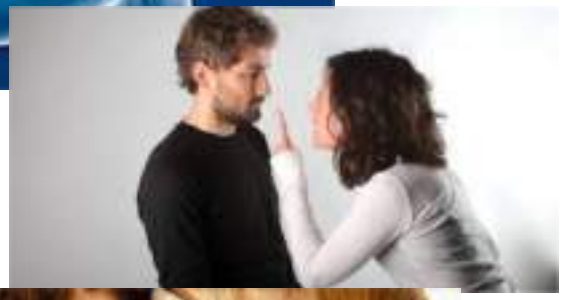
Si te quiere: te hará sufrir.

¿Por qué sigues con él?











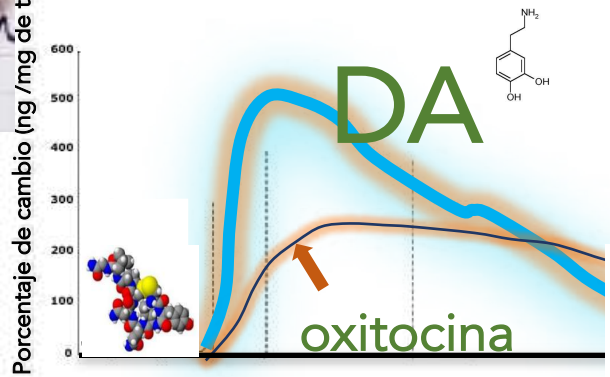
Tobias Esch; George Stefano. The Neurobiology of love. *Neuroendocrinol. Lett. 2005; 26 (3) 175-192*
Kimura D. 2002. Sex differences in the brain. Scientific American 25:1-5.

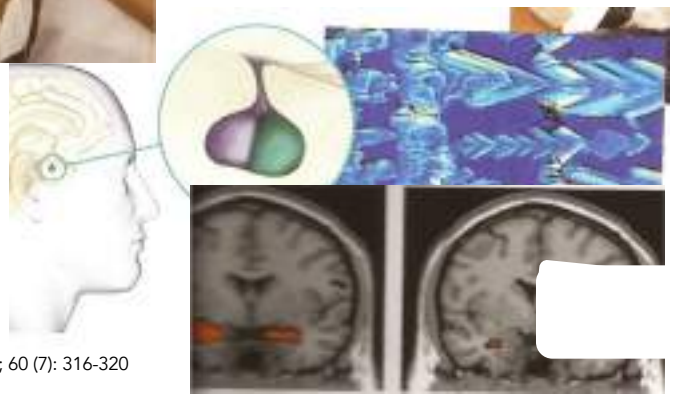
Oxitocina

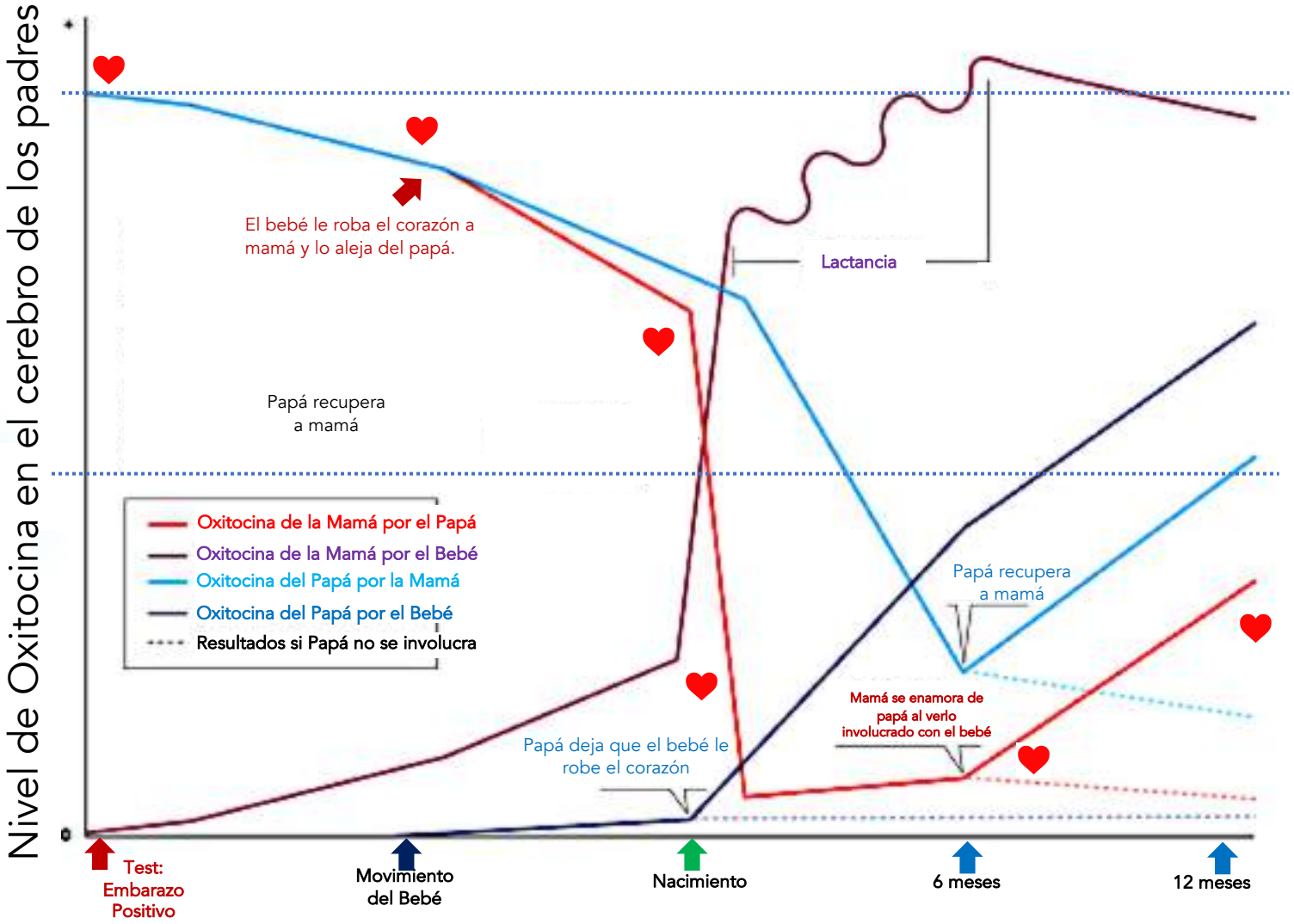
Apego, incremento del entorno social







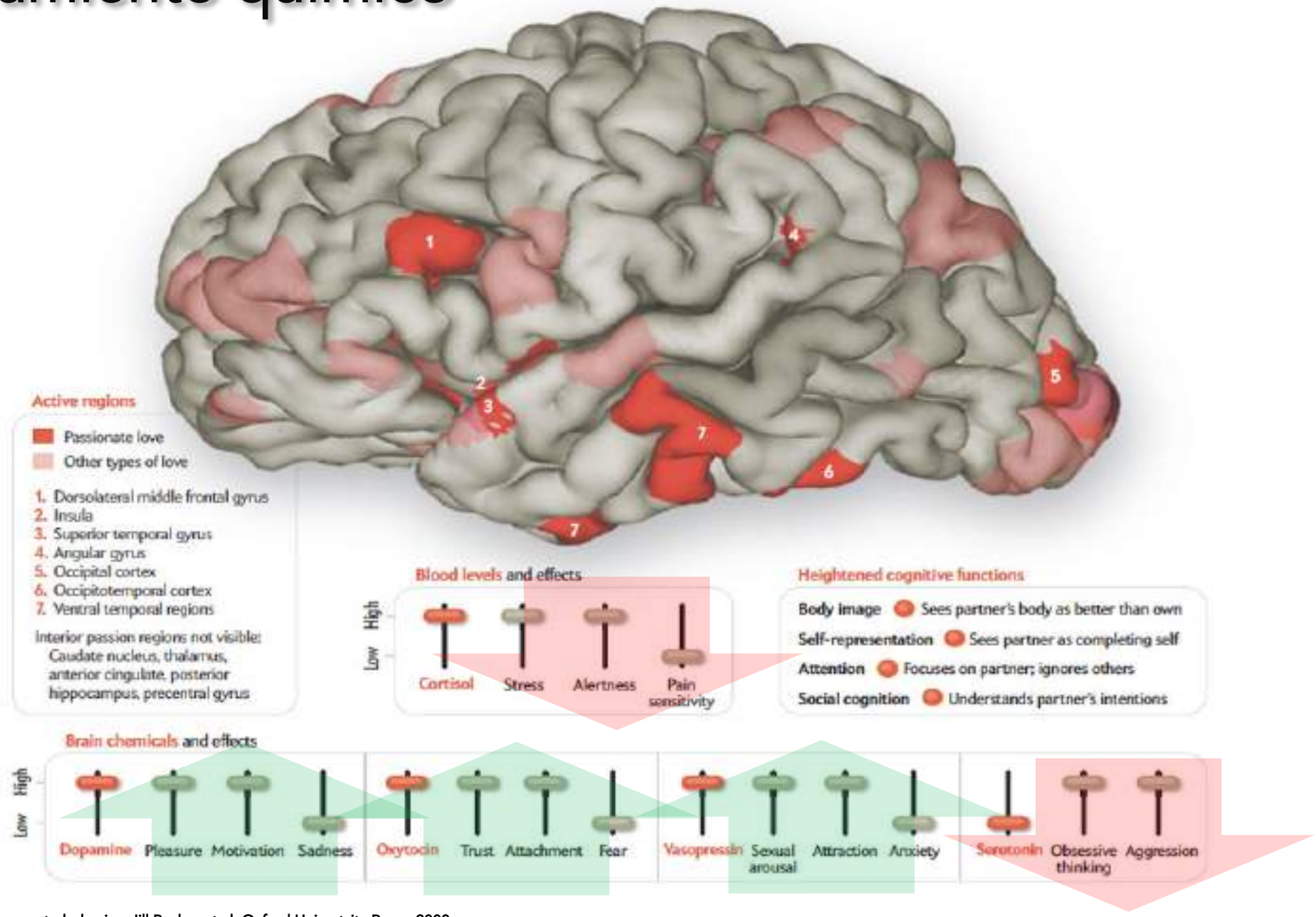




Oxitocina = apego

Rev Neurol 2015; 60 (7): 316-320

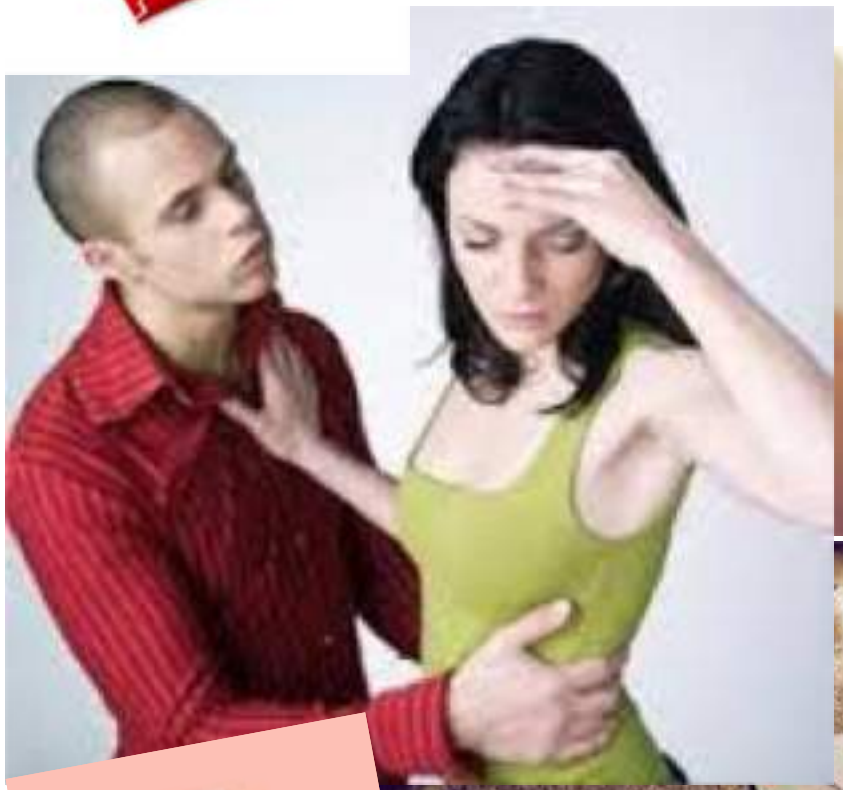
Enamoramiento químico



Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.



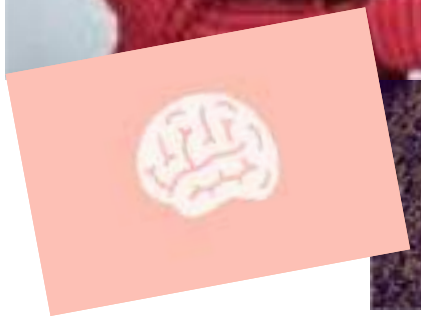
No hay amor de tu vida

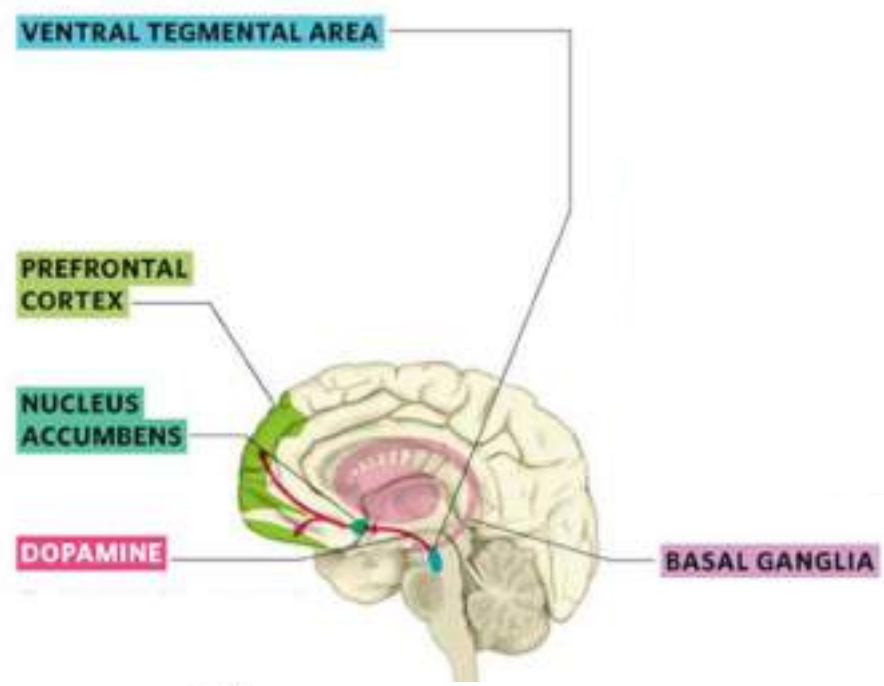


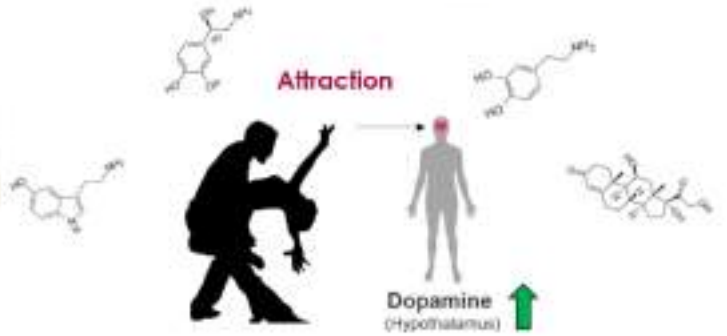










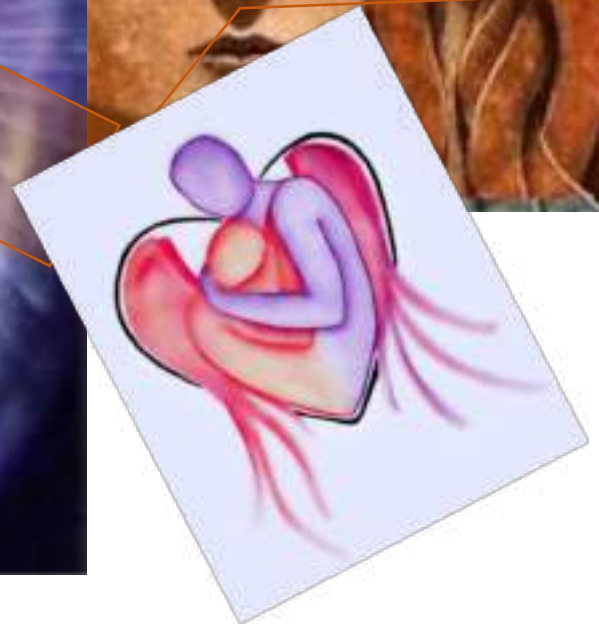


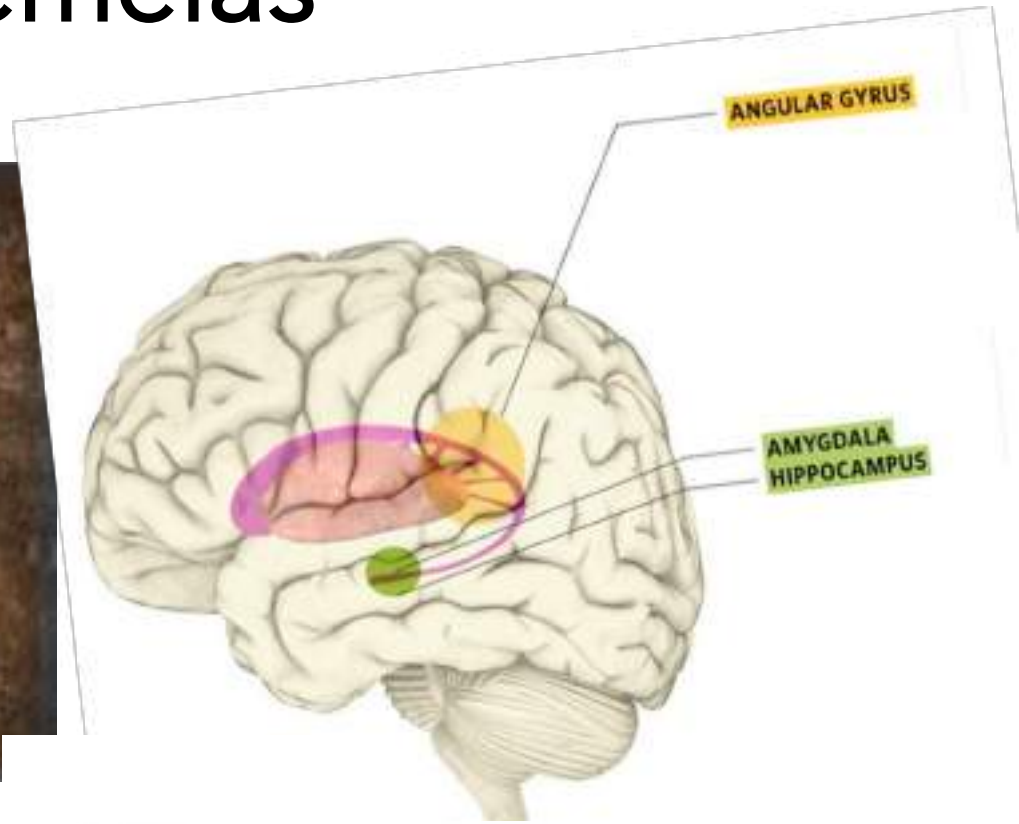
Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

No existen almas gemelas









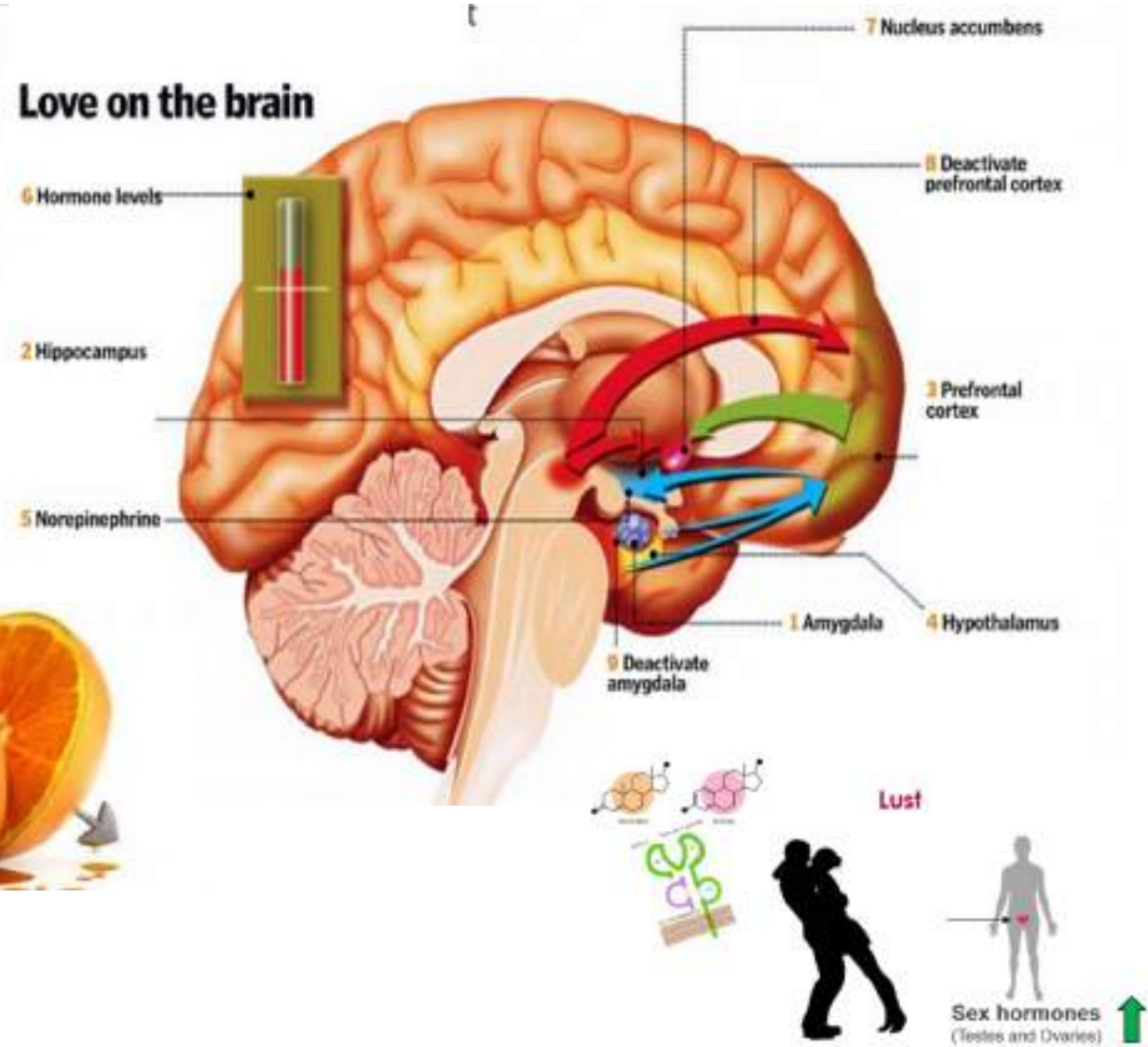


Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

No existen medias naranjas

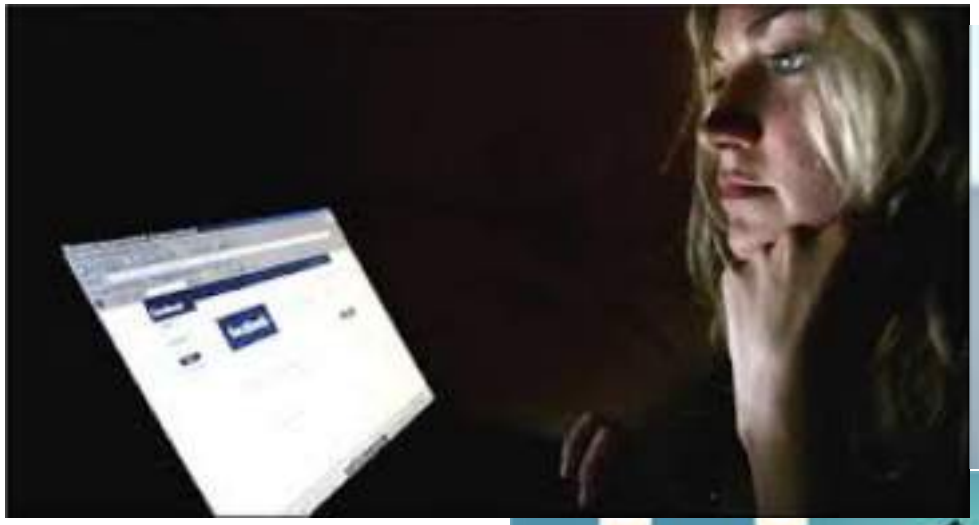






Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

No es necesario ser *voyeurista* de nuestra desgracia.











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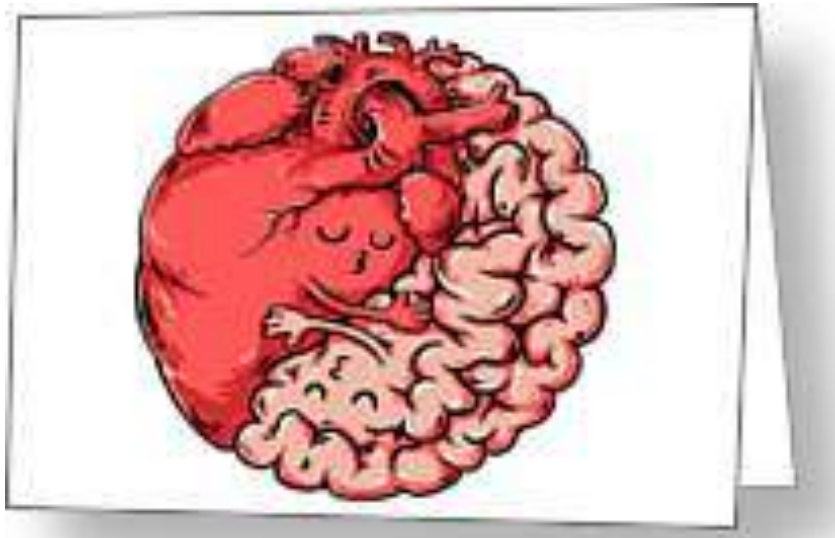


El amor a diferencia del enamoramiento, es duradero.



El amor es una percepción real del otro.

Tobias Esch; George Stefano. The Neurobiology of love. *Neuroendocrinol. Lett. 2005; 26 (3) 175-192*

Cuando una relación termina:
87% es porque ella puso el punto final.



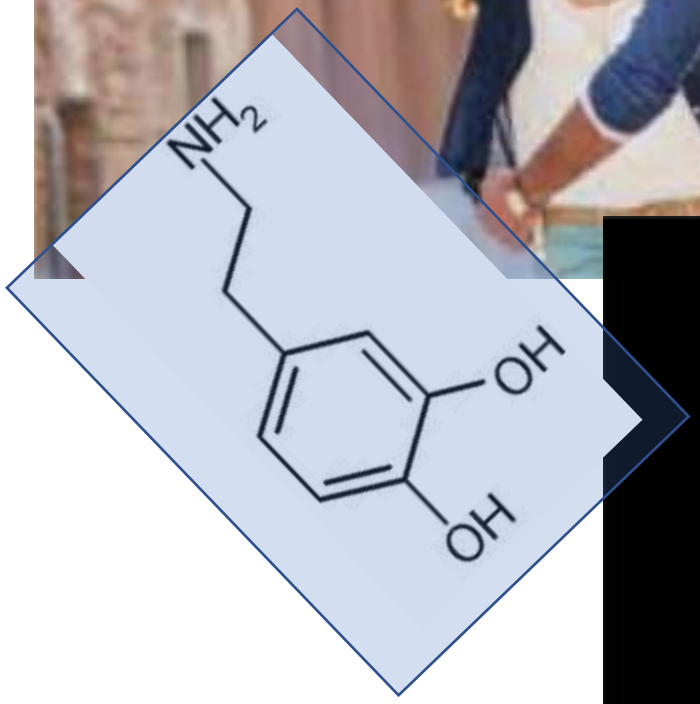




Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

Entre más te OPONGAS más te OBSESIONA









Síndrome Romeo-Julieta.



Tobias Esch; George Stefano. The Neurobiology of love. *Neuroendocrinol. Lett. 2005; 26 (3) 175-192*

Kimura D. 2002. Sex differences in the brain. Scientific American 25:1-5.

¿por qué quieres estar con alguien, que no quiere estar contigo?









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by UCIC

Sex differences in the brain: from genes to behavior. Jill Backer et al. Oxford Univertsity Press. 2008.
Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

Y...

¿para qué nos enamoramos?

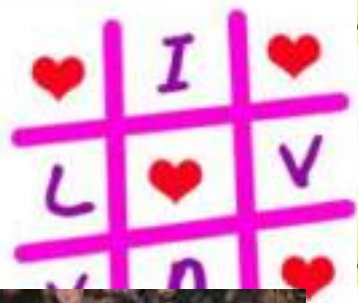








¿3 a 4 años?



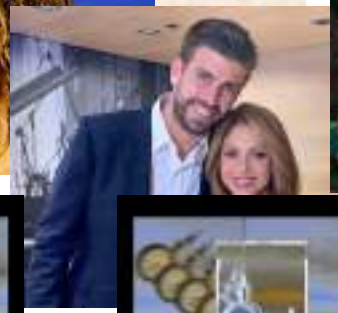


Desilusión
Desencanto
Desamor

















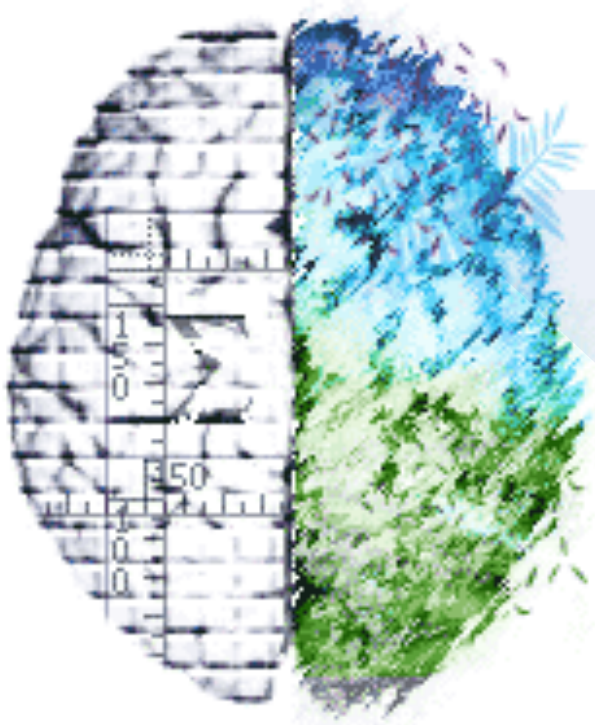


2025

Dopamina

2028

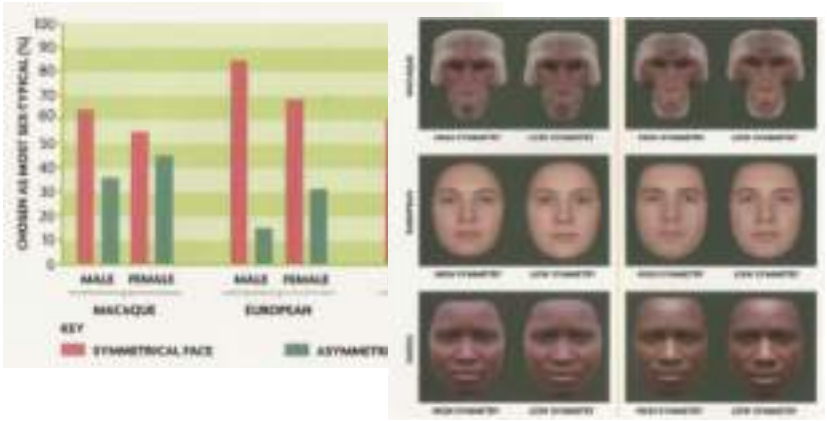
Para encontrar el Amor















Larry Cahill. 2009 The Sexual Brain. Scientific American Mind. 20 (3), 39-47.

Aprendizaje/ Social







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Aprendizaje/ Social

Inis Beag







La naturaleza tomará su curso











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by UCIC

Sexualidad Humana Hyde; De la mater MC Graw Hill, 2008.

Mangaia

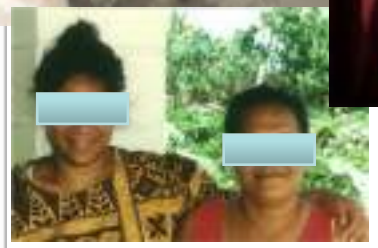
Aprendizaje/ Social



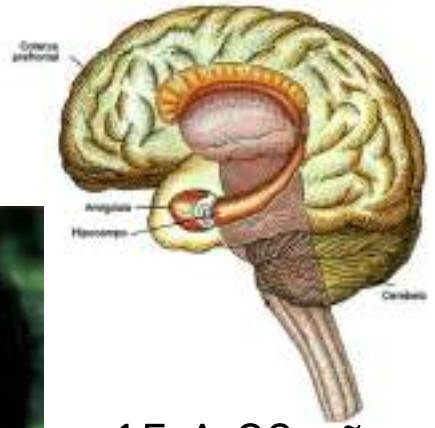












15 A 20 años =
6 novios amantes



13 a 20 años =
10 novias amantes

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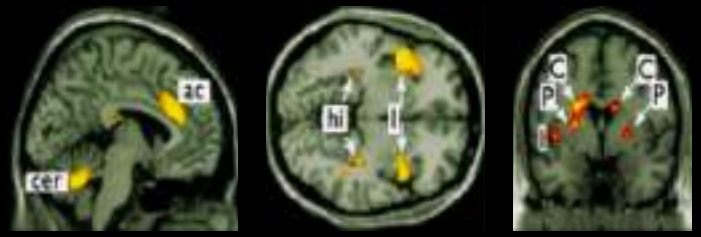
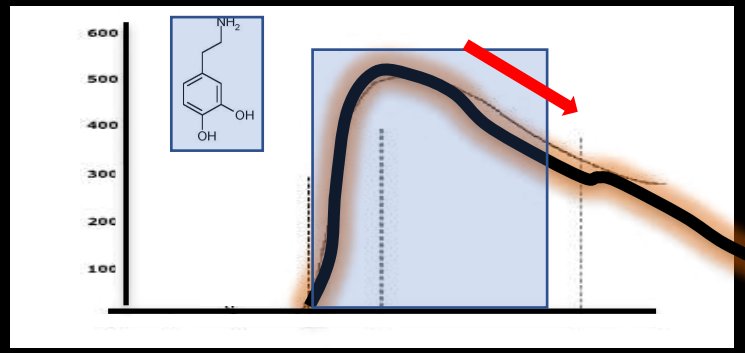
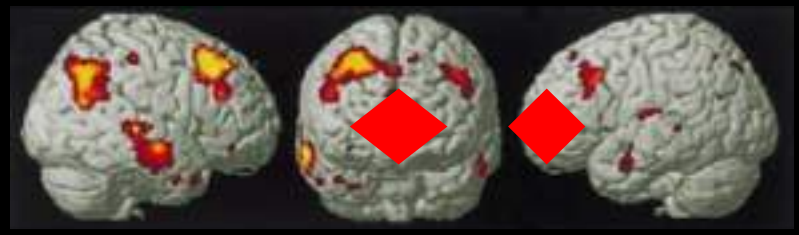
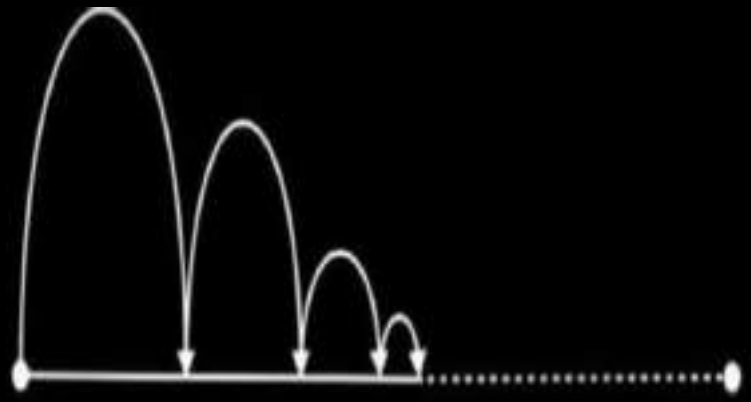
Sexualidad Humana Hyde; De la mater MC Graw Hill, 2008.

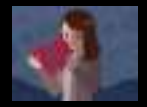
Amor NO necesariamente es un futuro que se desea contruir.
El amor ama, desea y ansia el PASADO que inconscientemente se deseas rescatar.


















Enamorarse es amar las coincidencias…
Amar es enamorarse de las diferencias

GRACIAS

Dr. Eduardo Calixto González

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Dirección de Investigaciones en Neurociencias
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