

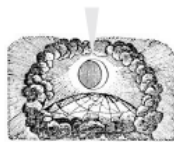
La Comunicación Neuronal en el Cerebro: un Milagro que Empezamos a Entender

Juan Lerma



Sala de los Caballeros XXIV. Palacio de la Madraza
Martes, 7 de Junio de 2011

**Aula de Ciencia
y Tecnología**



UNIVeX
Secretariado de Extensión
Universitaria



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de Granada



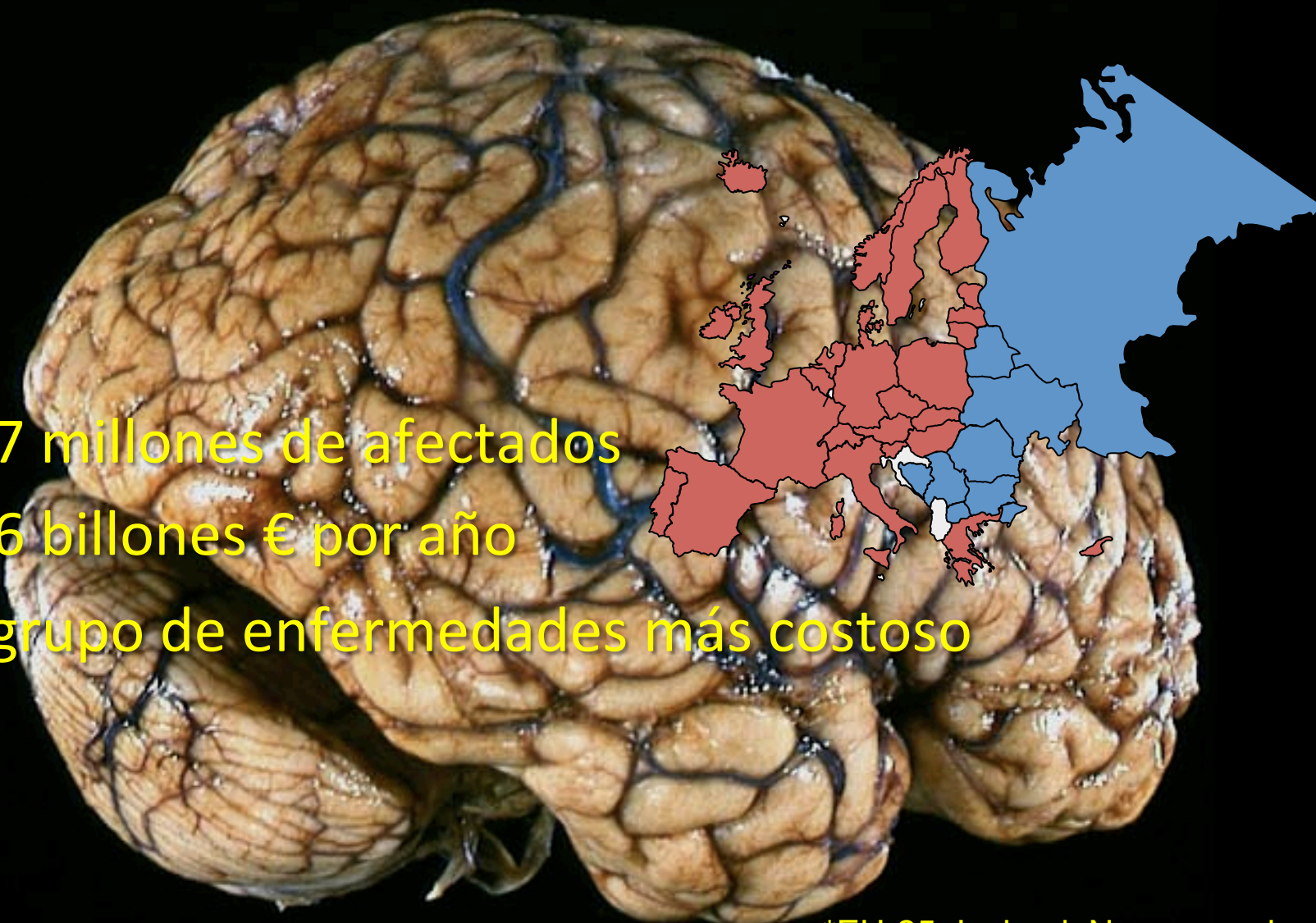
Un cerebro humano:

100.000.000.000 de neuronas perfectamente organizadas

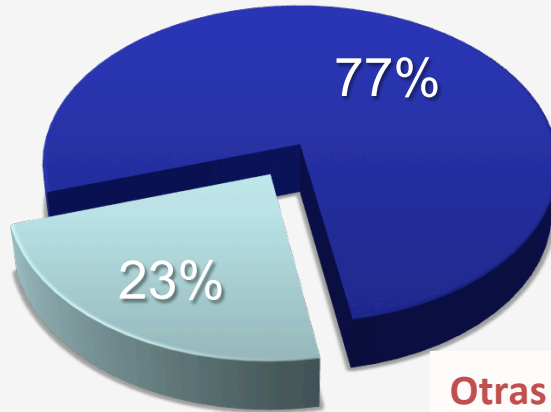


Enfermedades Cerebrales

- 127 millones de afectados
- 386 billones € por año
- El grupo de enfermedades más costoso



Años de vida perdidos

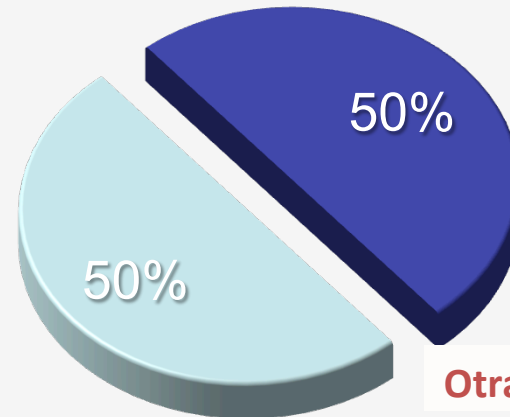


Otras Enfermedades

Enfermedades Cerebrales

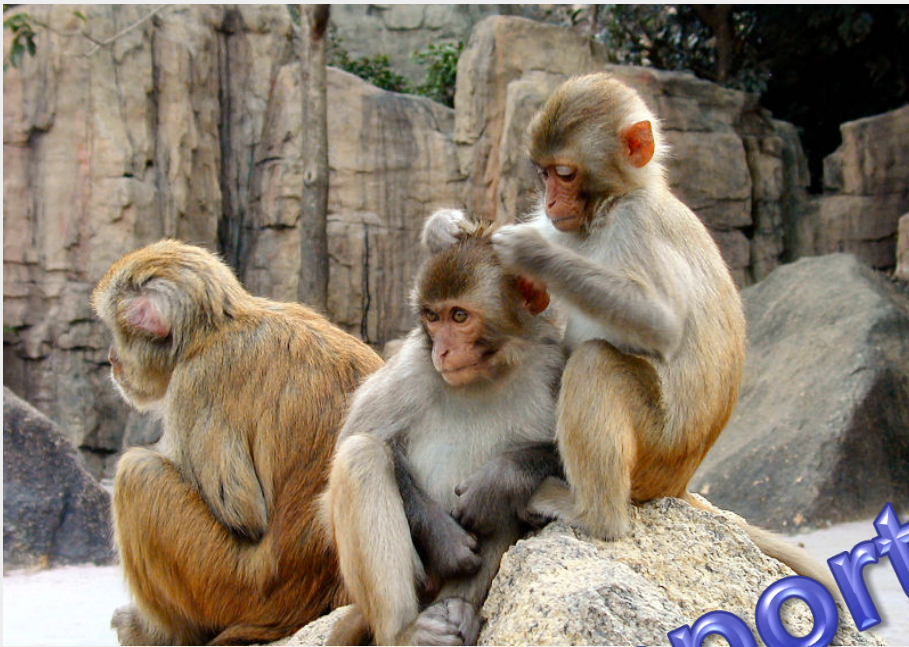


Años con la enfermedad



Otras Enfermedades

Enfermedades Cerebrales



Comportamiento Social



Photograph by Mitsuki Iwago
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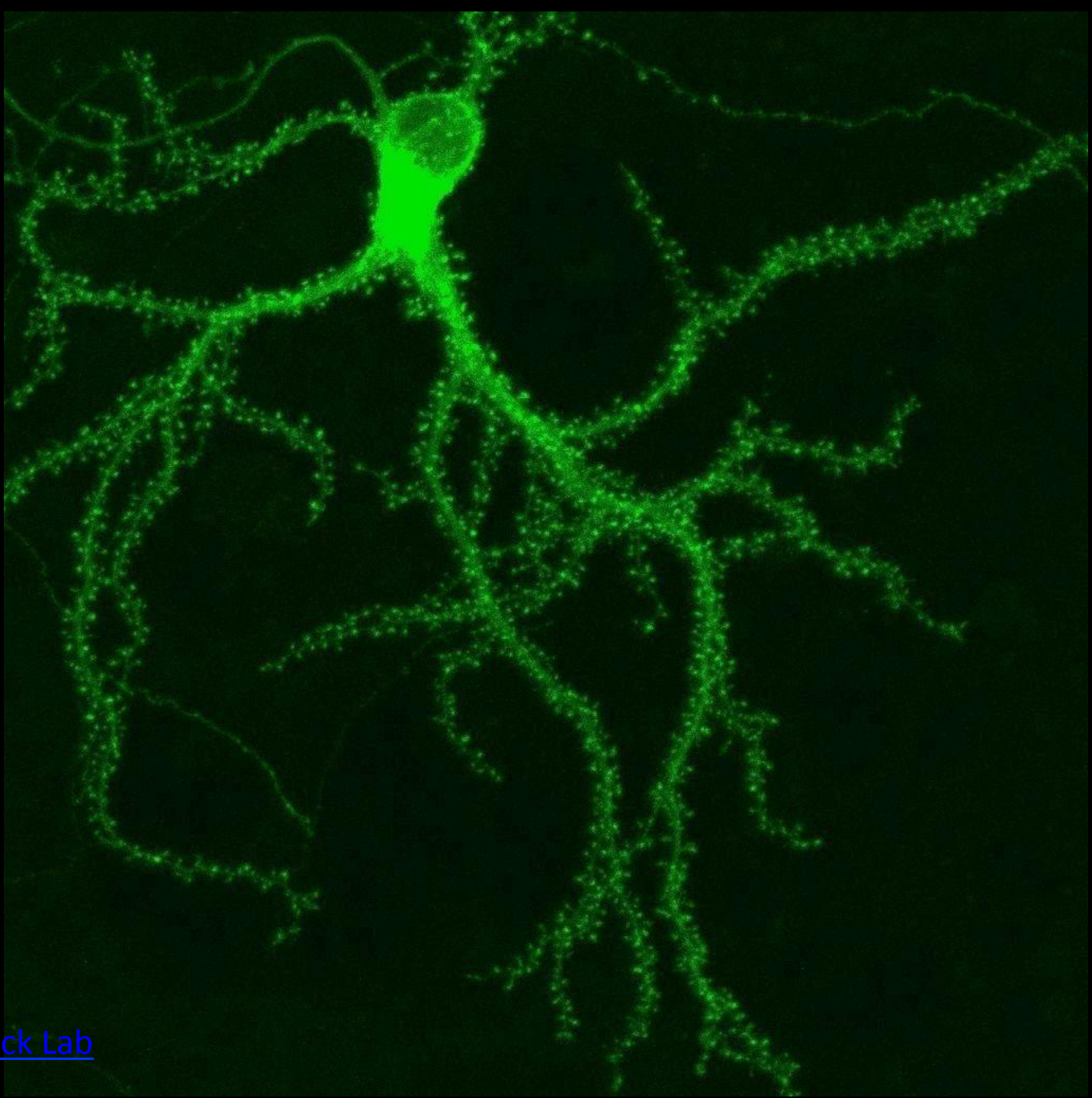
National Geographic Best of Wildlife
Collector's Edition Vol. III

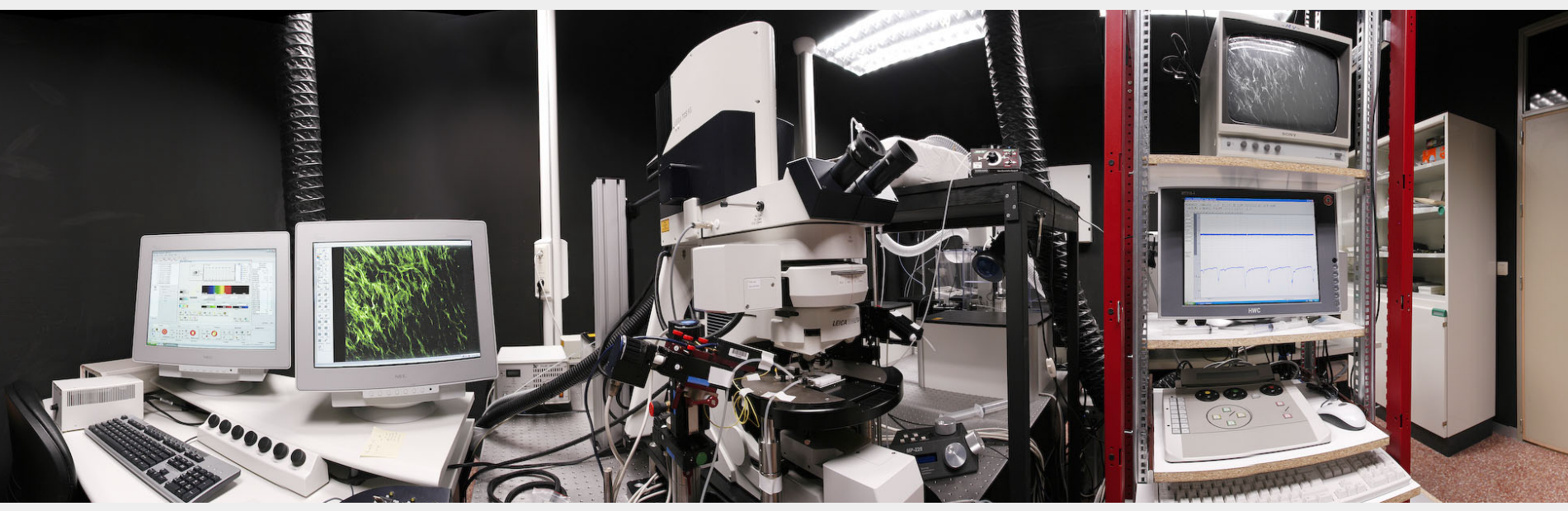
Photograph by Frans Lanting
© 2002 National Geographic Society. All rights reserved.

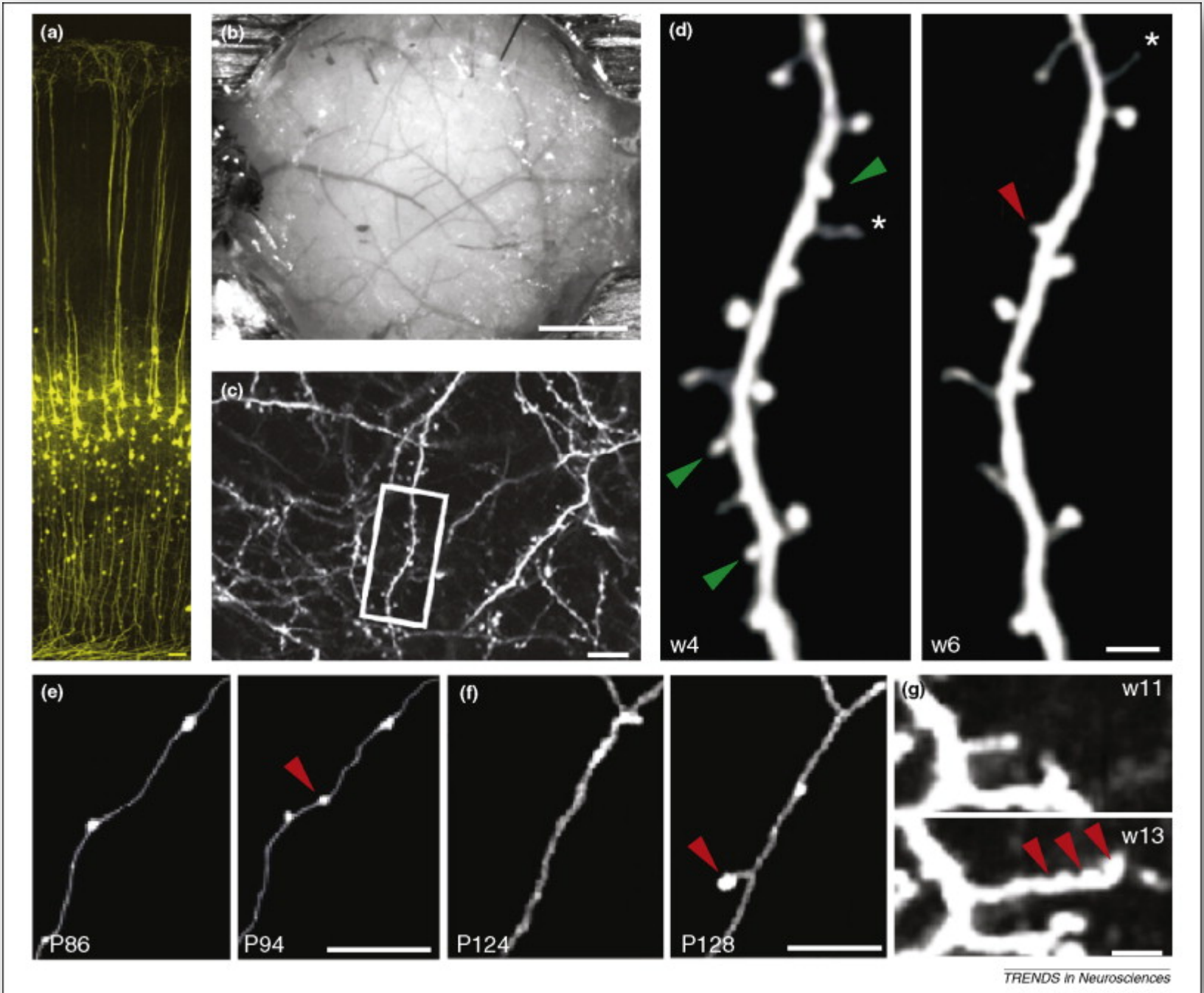
National Geographic Best of Wildlife
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Cómo interpreta el cerebro la
visión correcta del mundo



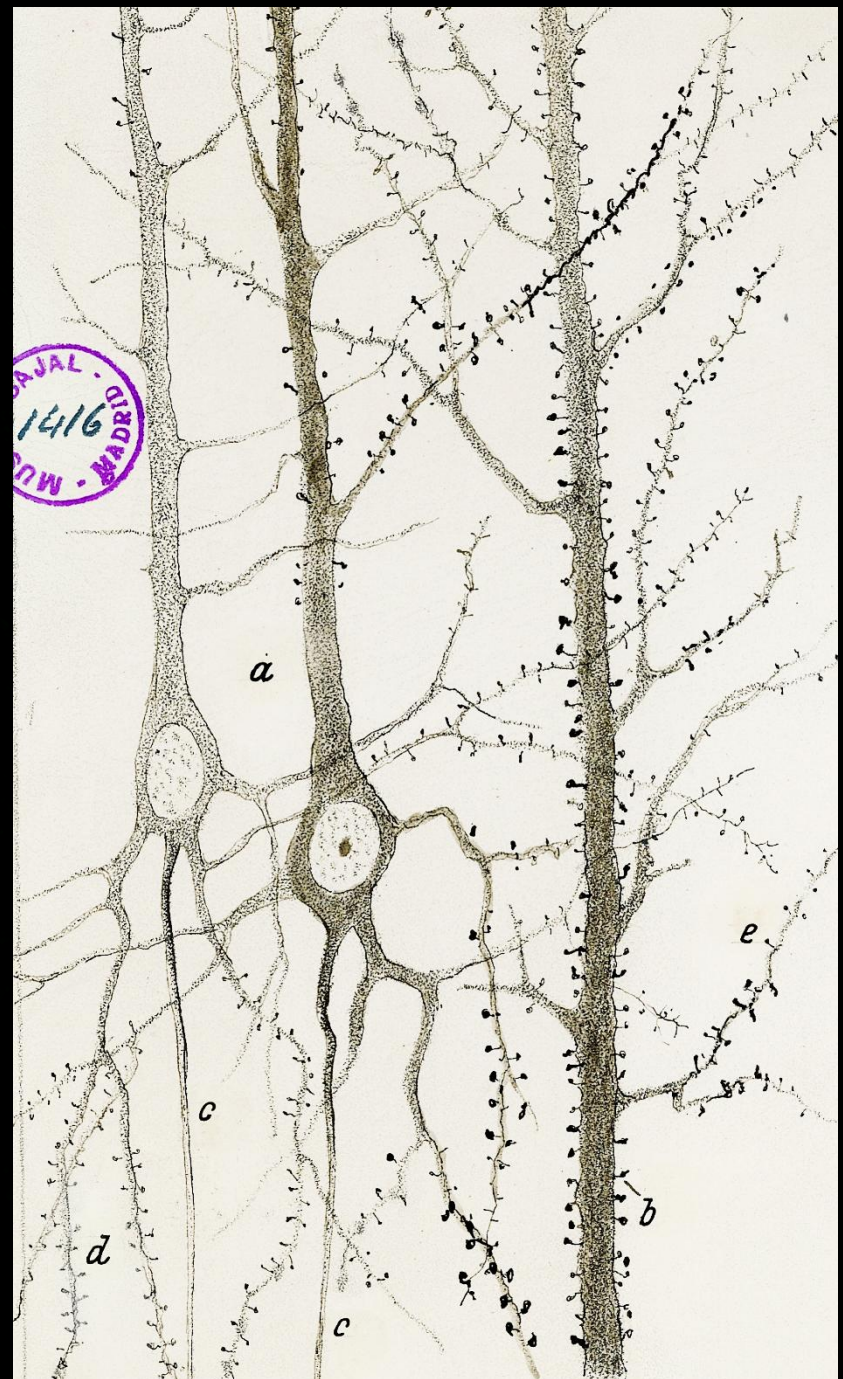
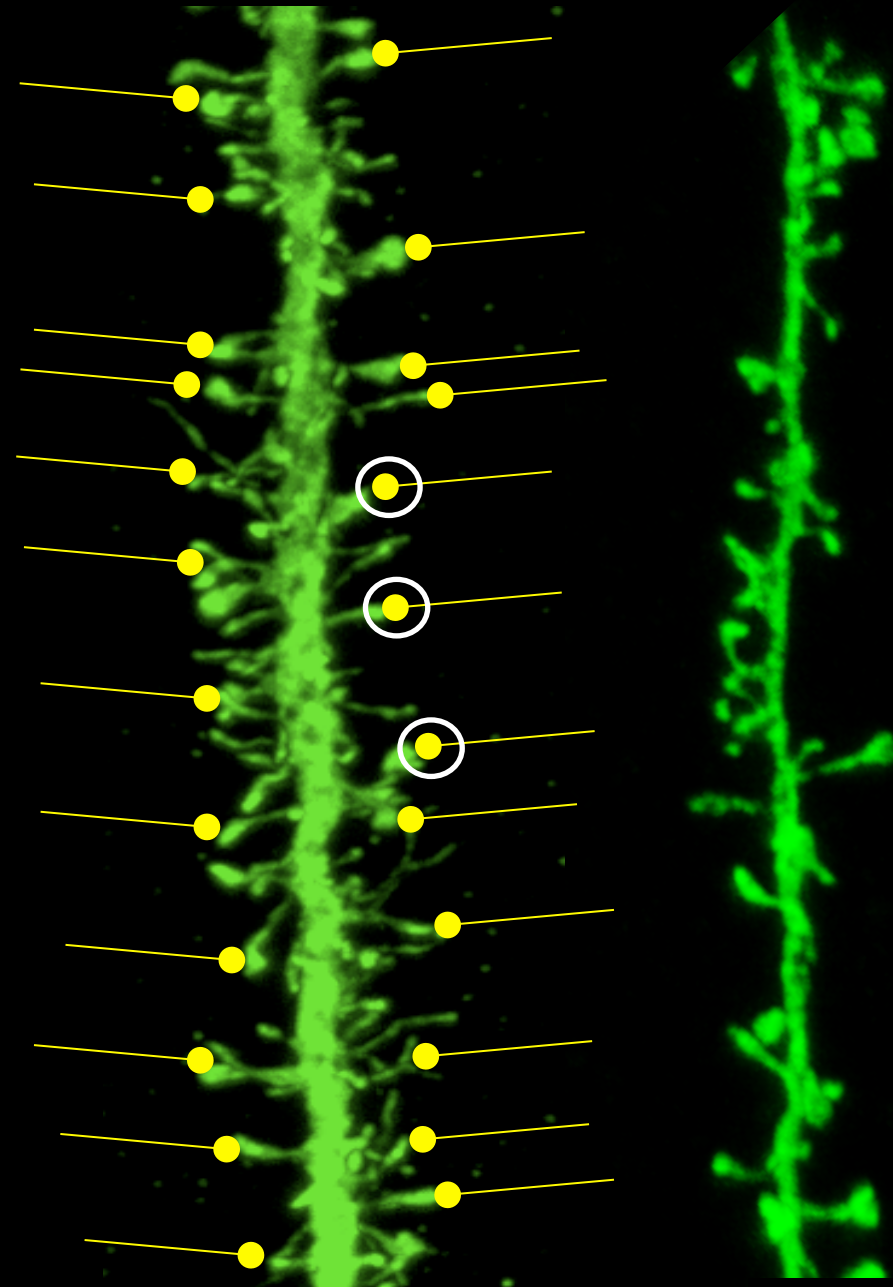






41 años

84 años



Some Important Findings of Neuroscience in XXth Century

The Neuronal Theory



Dynamic Polarization

A Common Mechanism of Signalling: Action Potential

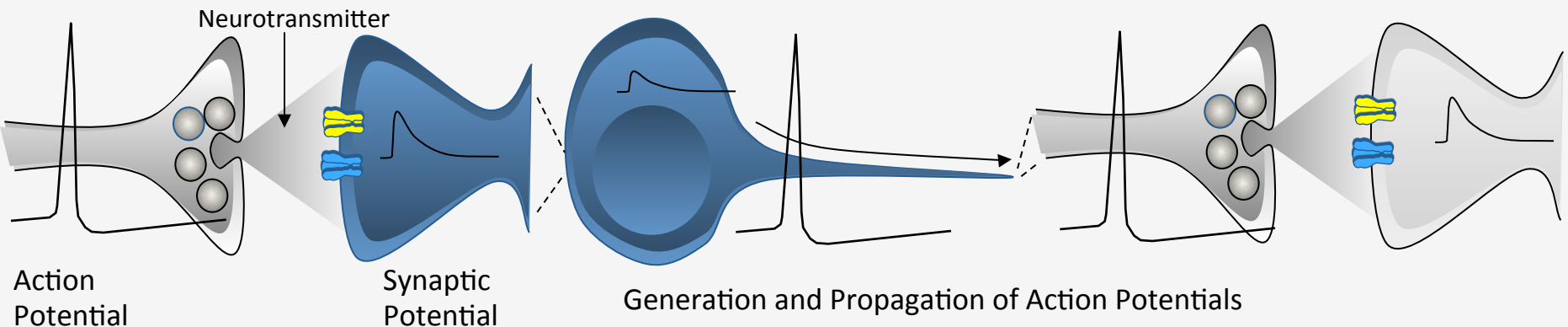
Ionic Mechanisms for Generation and Propagation of Action Potentials

Ion Channels

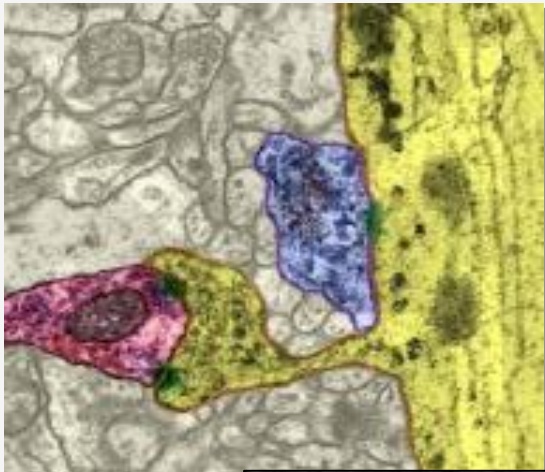
Synapses

Chemical Messengers

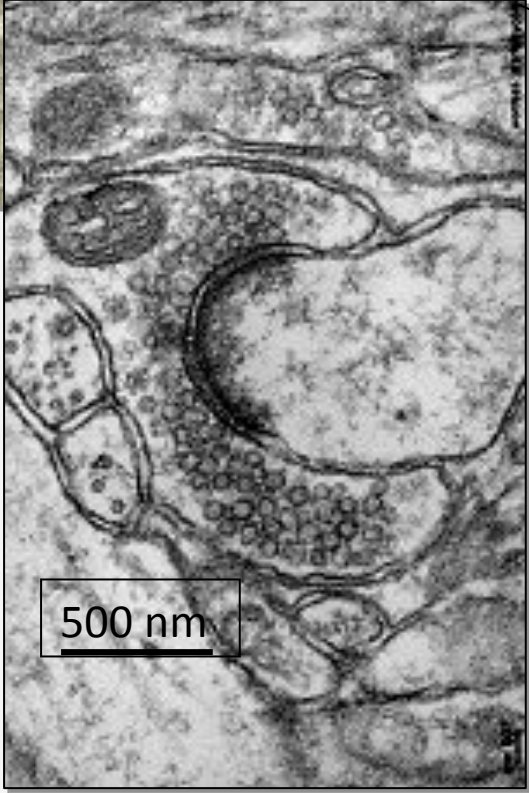
Excitation & Inhibition



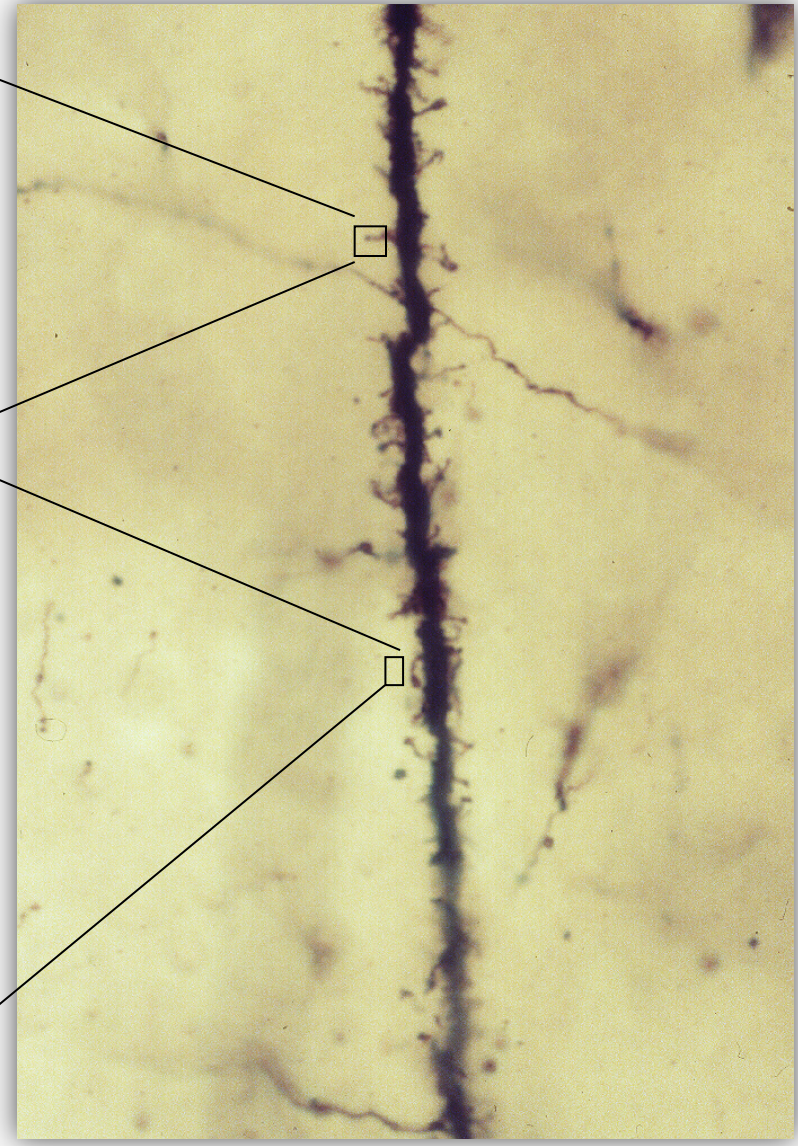
Electron Microscopy



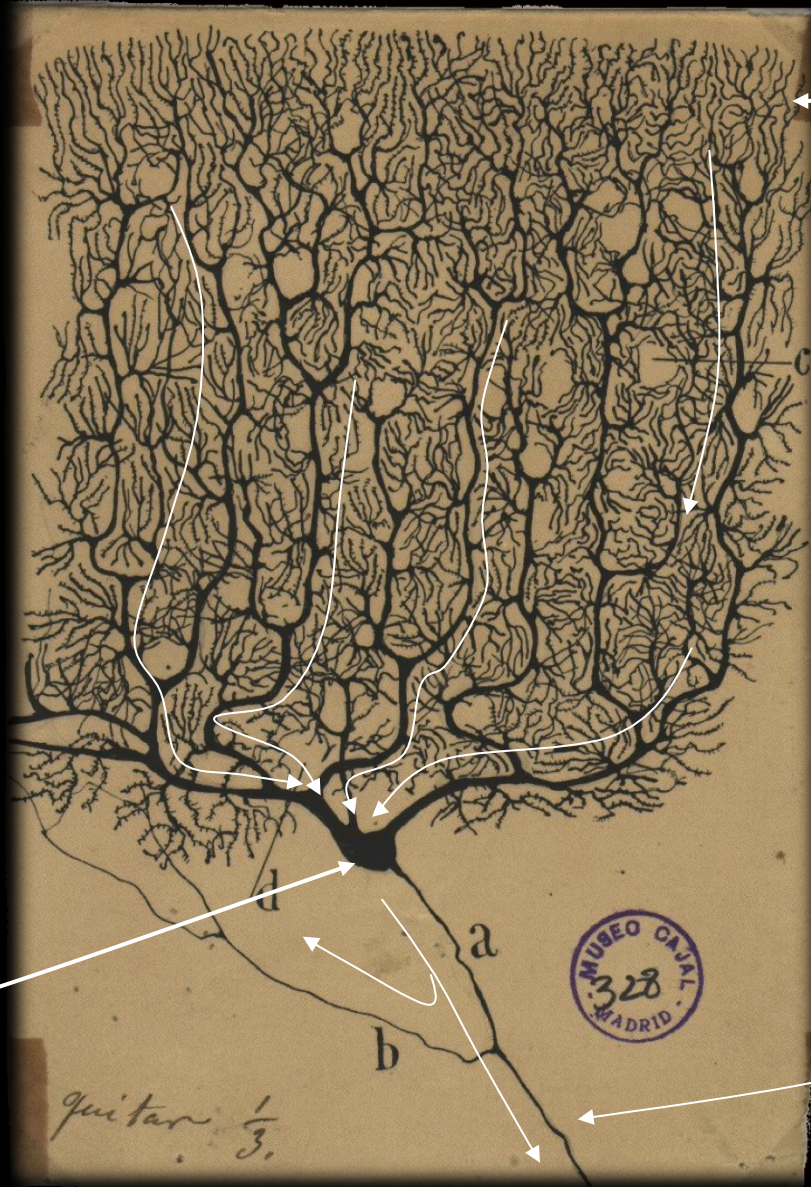
1 μm



500 nm



Original Cajal's preparation (Golgi)



Dendrites: INPUT

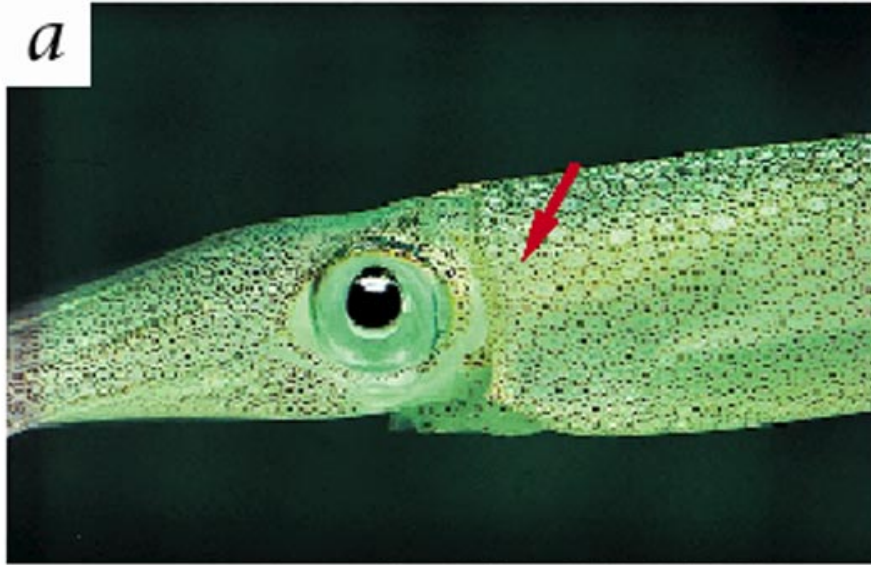
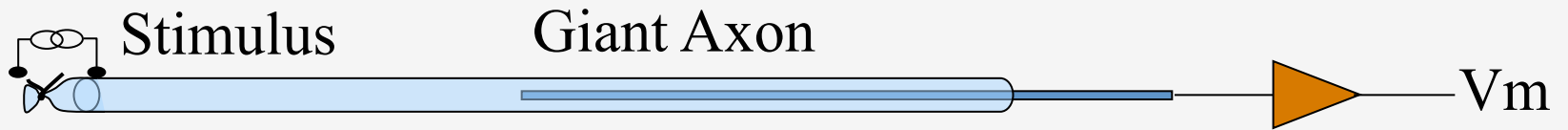
Cell Body

Axon: OUTPUT

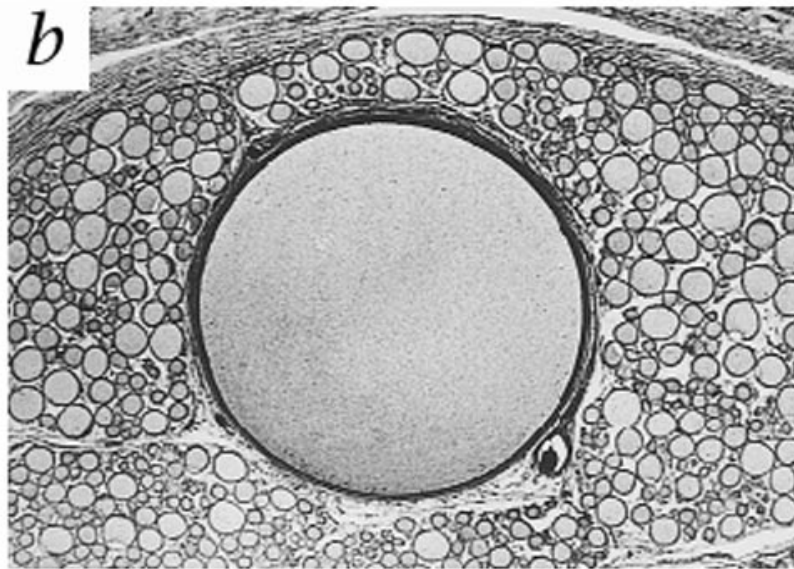


quitar $\frac{1}{3}$.

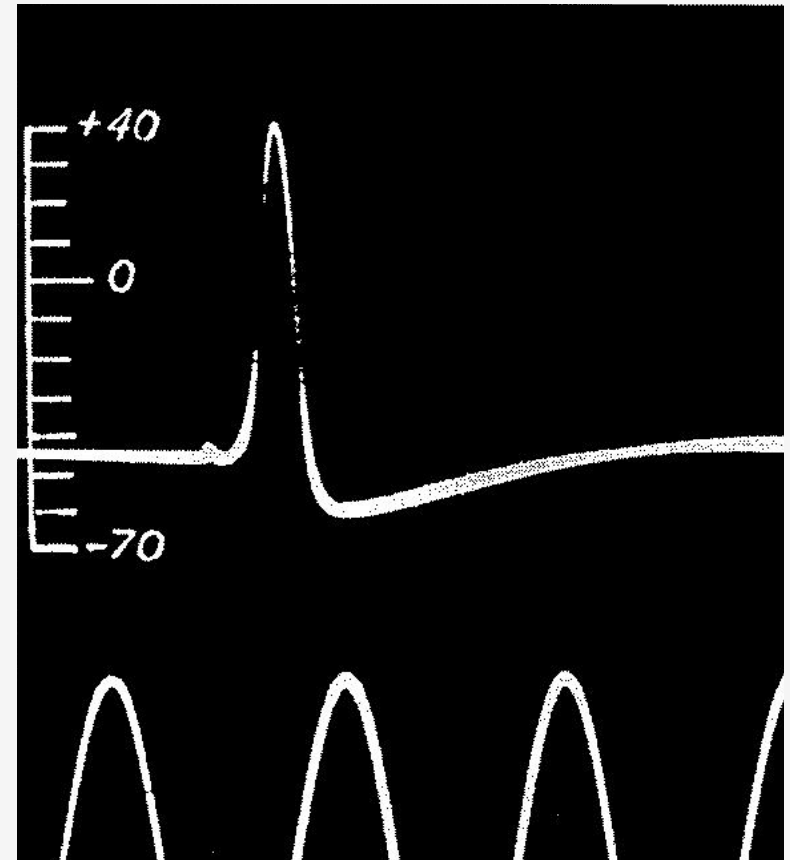




Courtesy of Roger T. Hanlon, Marine Biological Laboratory



Courtesy of Kay Cooper, Marine Biomedical Institute



Hodgkin and Huxley, 1939



Nobel Prize in Physiology or Medicine 1963



ECCLES, Sir JOHN CAREW,
Australia, Australian National University,
Canberra, 1903-1997



HODGKIN, Sir ALAN LLOYD,
Great Britain, Cambridge University,
Cambridge, 1914-1998



HUXLEY, Sir ANDREW FIELDING,
Great Britain, London University,
1917-

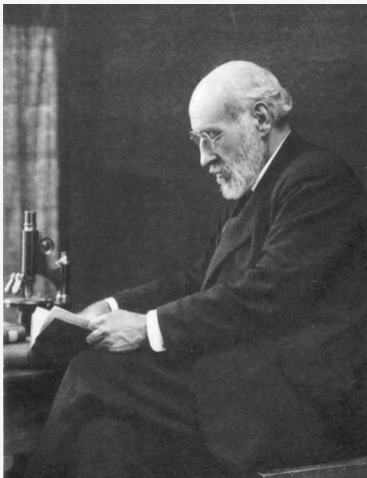
"for their discoveries concerning the ionic mechanisms involved in excitation and inhibition in the peripheral and central portions of the nerve cell membrane"





1897 Sherrington named the place where an axon makes a functional contact with another neuron as SYNAPSIS

Charles S. Sherrington
Nobel Prize Physiology or Medicine, 1932



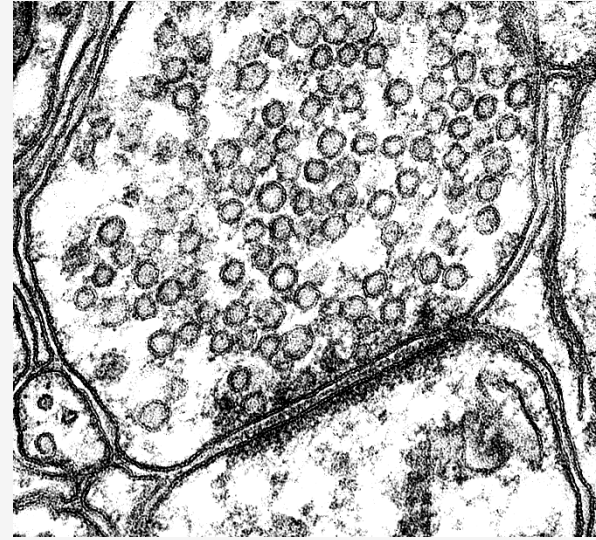
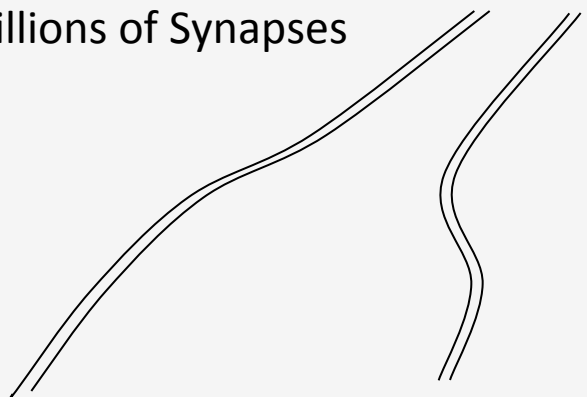
1899-1904, Cajal publishes “La Textura del Sistema Nervioso del Hombre y los Vertebrados”, later translated into French (1911) (1000 cit/5 yrs).

Santiago Ramón y Cajal
Nobel Prize Physiology or Medicine, 1906

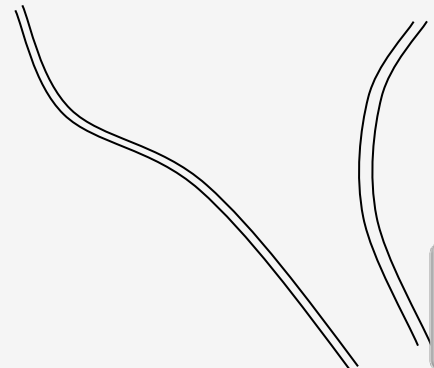


Graham Johnson '04

100,000 millions of Neurons
100 **b**illions of Synapses



Constantino Sotelo

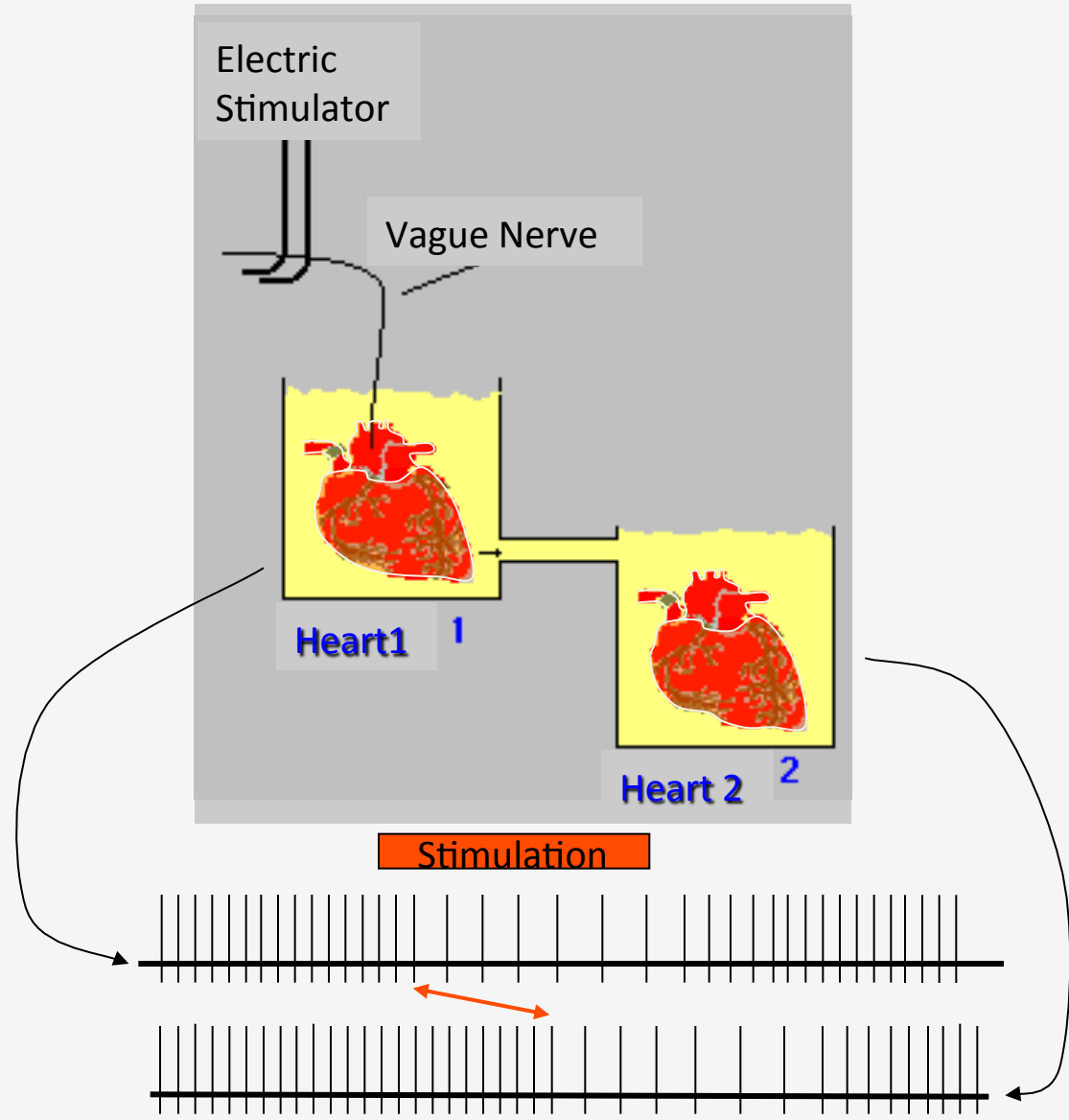


Henry H. Dale
(1875-1968)
Nobel Prize 1936



Otto Loewi (1873-1961)
Nobel Prize 1936

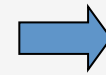
The experiment by Otto Loewi



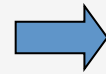
Some Neurotransmitters in the Nervous System

Category	Name	Abbreviation	Receptor Type	
			Metabotropic	Ionotropic
Amino acids	Glutamate	Glu	Metabotropic Glutamate receptors (mGluRs)	NMDA, Kainate and AMPA receptors (iGluRs)
Amino acids	Gamma-aminobutyric acid	GABA	GABA _B receptor	GABA _A , GABA _A - ρ receptor
Amino acids	Glycine	Gly	-	Glycine receptor
ACETYLCHOLINE	Acetylcholine	Ach	Muscarinic AchR	Nicotinic AchR
Monoamine	Dopamine	DA	Dopamine receptor	-
Monoamine	Norepinephrine (noradrenaline)	NE	Adrenergic receptor	-
Monoamine	Epinephrine (adrenaline)	Epi	Adrenergic receptor	-
Monoamine	Serotonin (5-HT)	5-HT	Serotonin receptor	5-HT ₃
Monoamine	Histamine	H	Histamine receptor	-
PP: Gastrins	Cholecystokinin	CCK	Cholecystokinin receptor	-
PP: Neurohypophyseals	Vasopressin	AVP	Vasopressin receptor	-
PP: Neurohypophyseals	Oxytocin		Oxytocin receptor	-
PP: Neuropeptide Y	Neuropeptide Y	NY	Neuropeptide Y receptor	-
PP: Opioids	Dynorphin		-	-
PP: Opioids	Endorphin		-	-
PP: Opioids	Enkephaline		-	-
PP: Secretins	Secretin		Secretin receptor	-
PP: Secretins	Motilin		Motilin receptor	-
PP: Secretins	Glucagon		Glucagon receptor	-
PP: Secretins	Vasoactive intestinal peptide	VIP	VIP receptor	-
PP: Somatostatins	Somatostatin		Somatostatin receptor	-
SS: Tachykinins	Substance P		-	-
Gas	Nitric oxide	NO	Soluble guanylyl cyclase	-
Cannabinoids	Anandamide	AEA	Cannabinoid receptor	-
ATP	Adenosine triphosphate	ATP	P2Y ₁₂	P2X receptor

Synthesis-storage-release-degradation.
 Number and/or activity of receptors



Learning, Memory

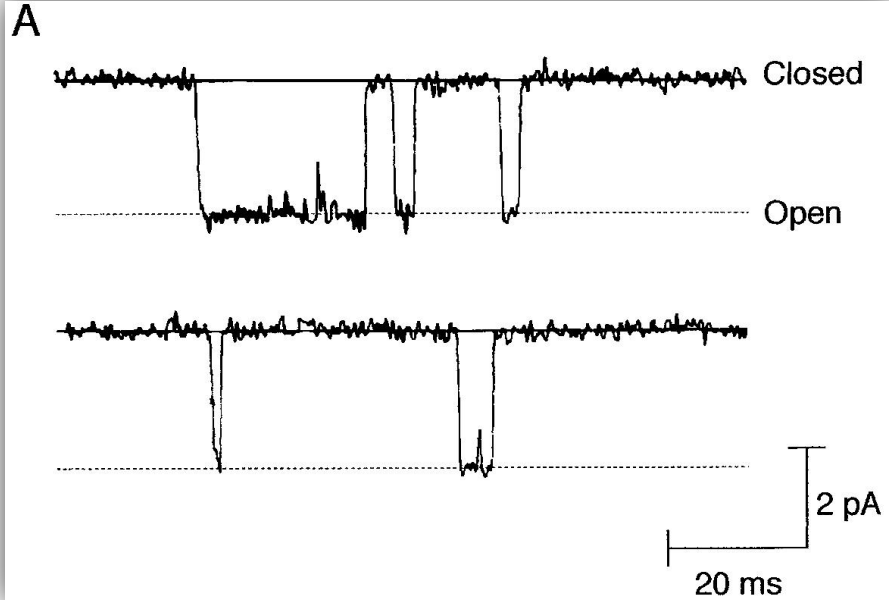
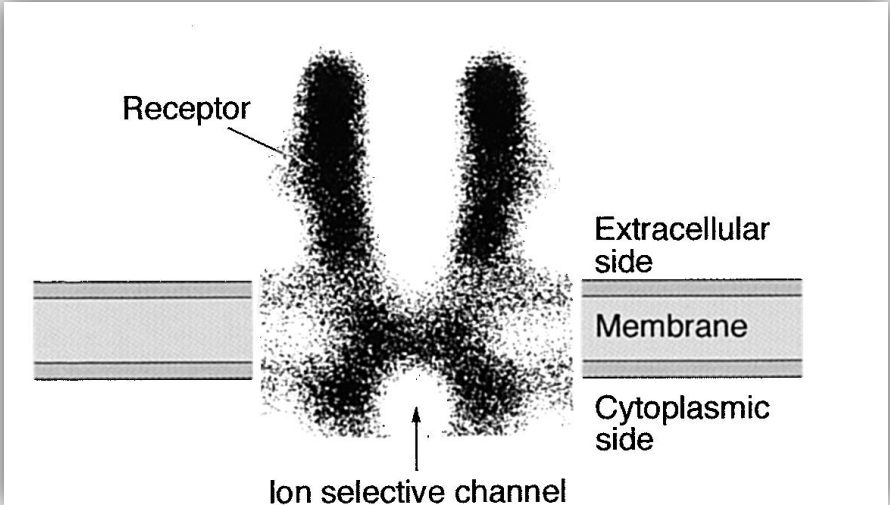
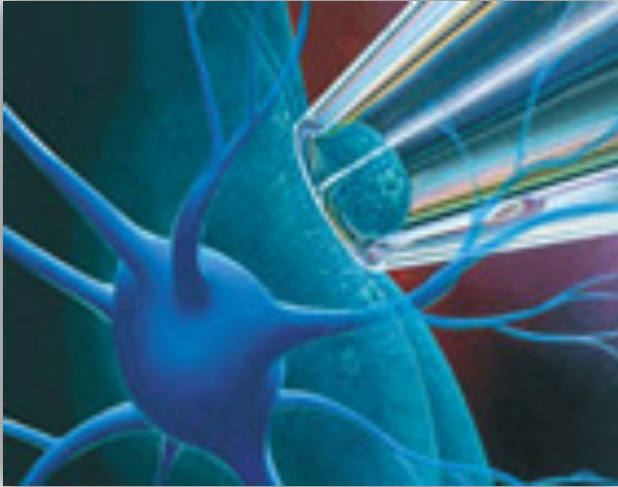


Clinic syndromes

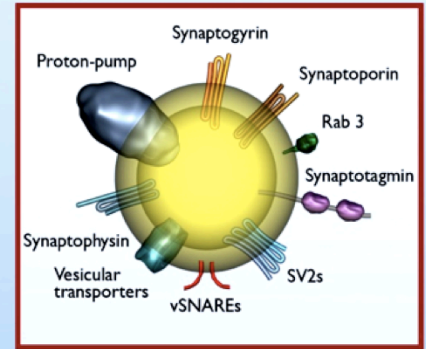
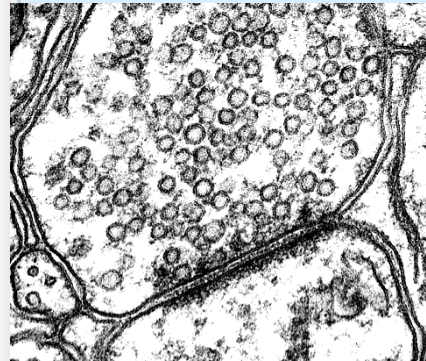
Disease	Cause	Treatment
Anxiety	Low activity of inhibitory synapses (GABA)	Benzodiazepines, which work enhancing GABA Receptor activity
Depression	Low levels of NA and 5-HT; high 5HT2 receptor density	Drugs inhibiting 5-HT and NA reuptake. MAO inhibitors
Huntington's Chorea	Increased Glutamate Release; Neuronal loss by death	Doesn't exist
Parkinson's disease	Loss of Dopaminergic neurons. Caudate Nucleus hyperactivity	L-DOPA; MAO-B inhibitors; Drugs stimulating D1 y D2 receptors
Epilepsy	Unbalance between inhibitory (GABA) and excitatory (Glu) activities	GABA receptor modulators
Miastenia gravis	Inactivation of ACh receptors	Anticholynesterase drugs



The Patch-Clamp Technique Allows Measurement of Single Ion Channel Activity



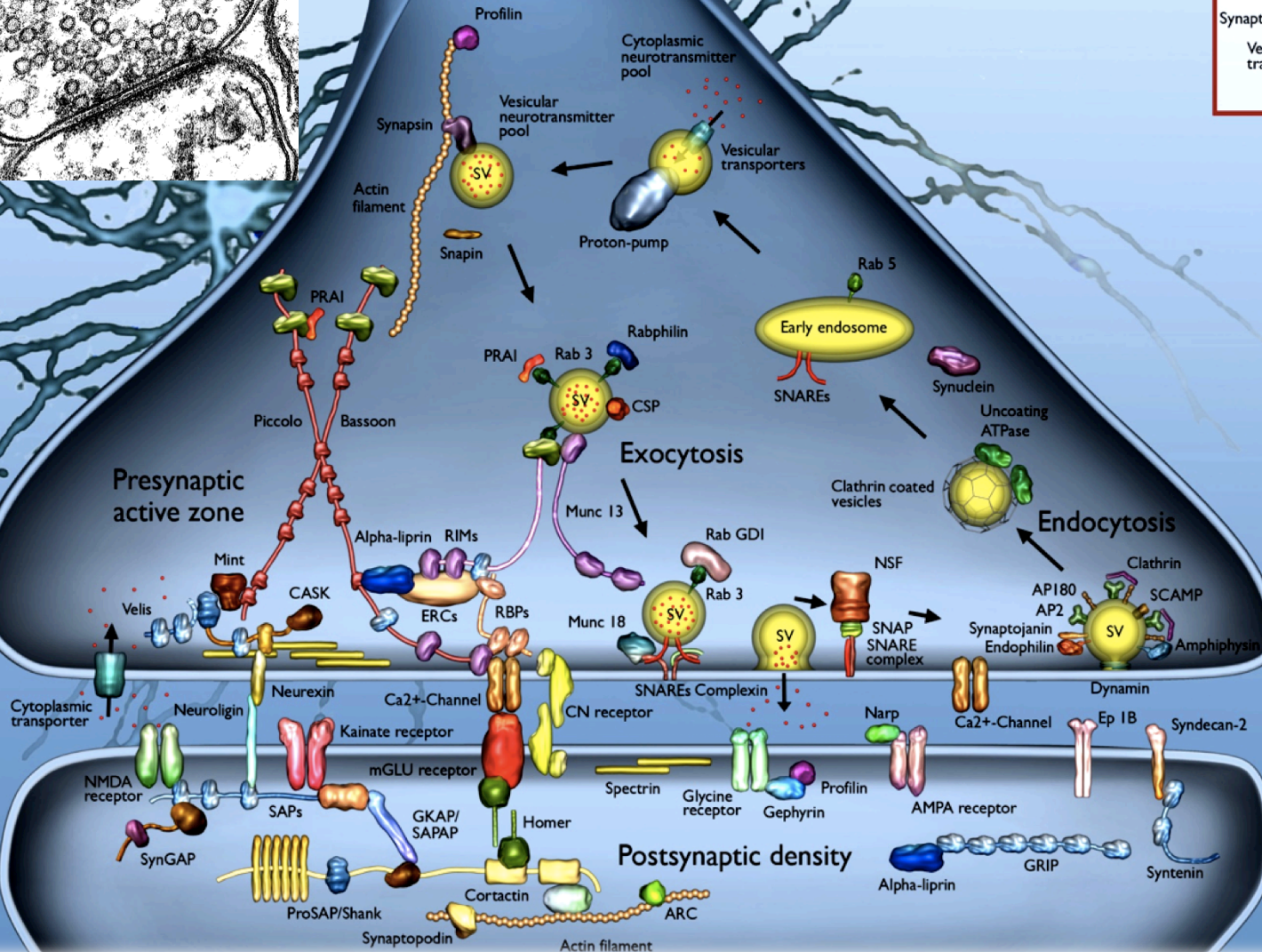
Function and Distribution of Synaptic Proteins



Antibodies for the Neuroscientist and Cellbiologist

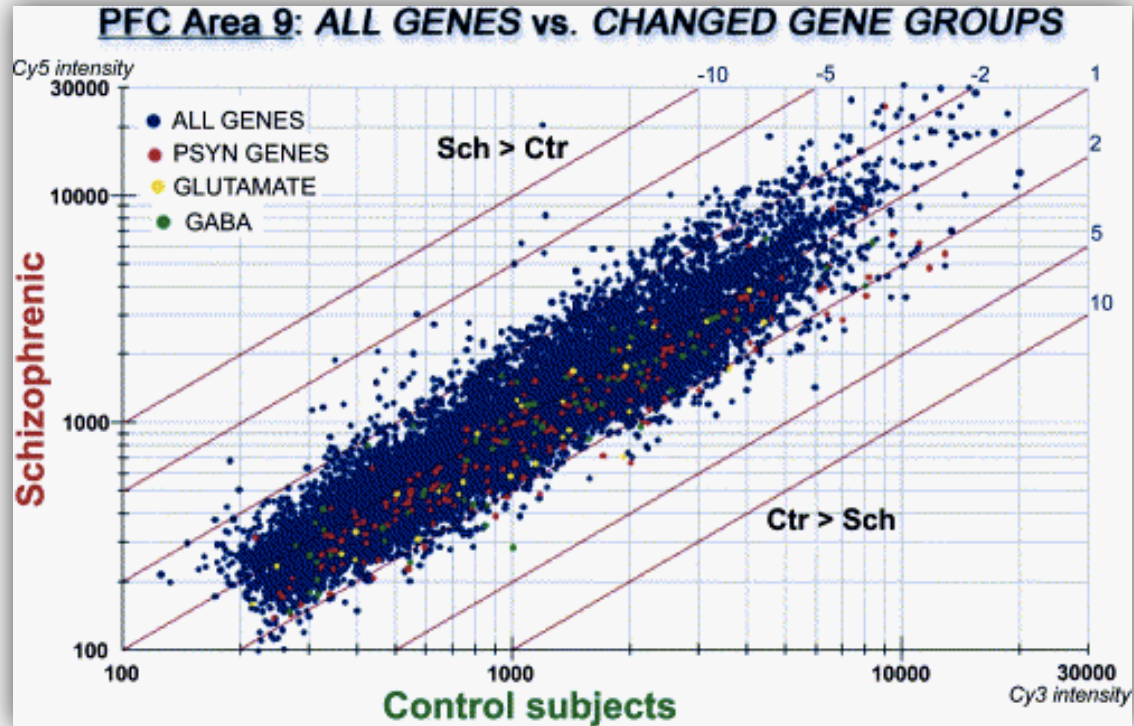
For further information contact sales@sysy.com

Or have a look at our web site: www.sysy.com

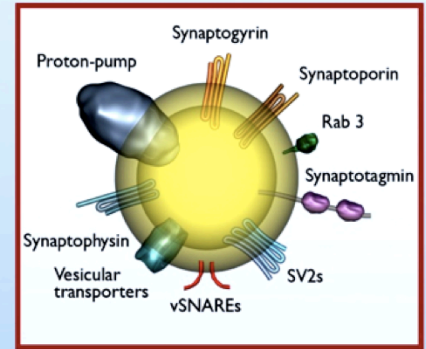


SYSY
Synaptic Systems

The Synaptic Hypothesis of Schizophrenia

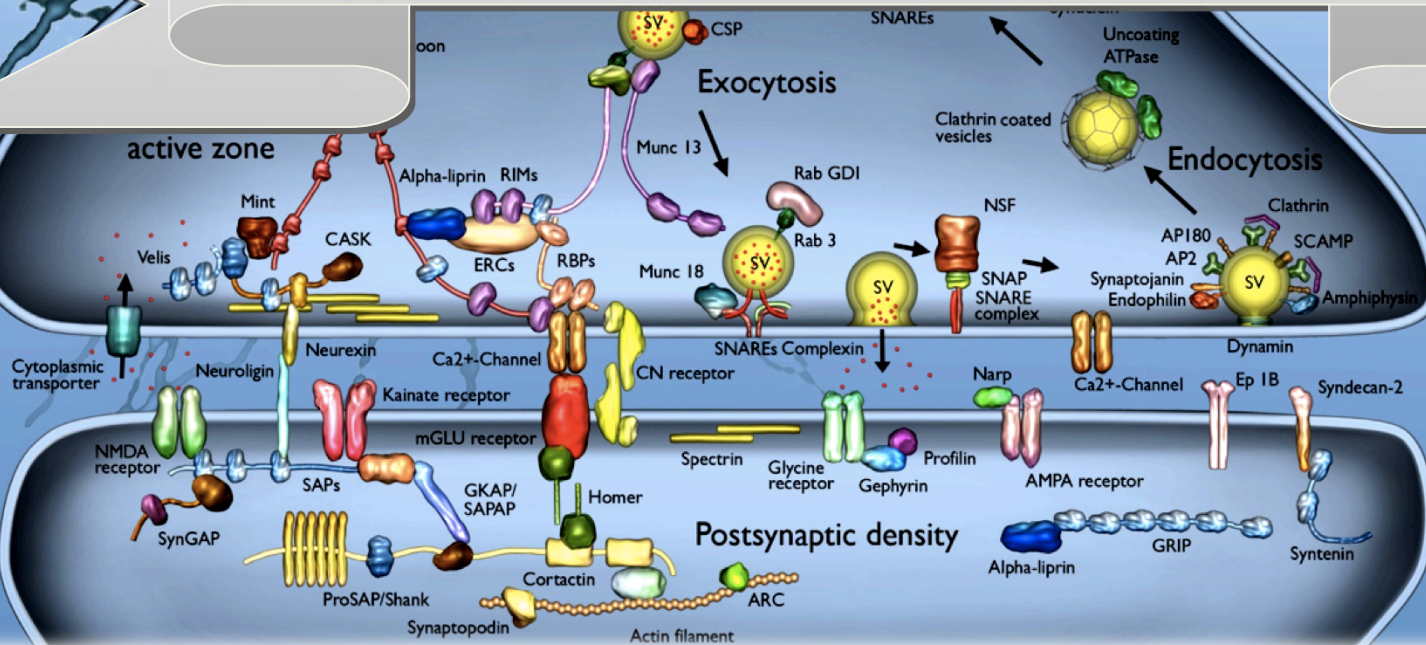


Function and Distribution of Synaptic Proteins



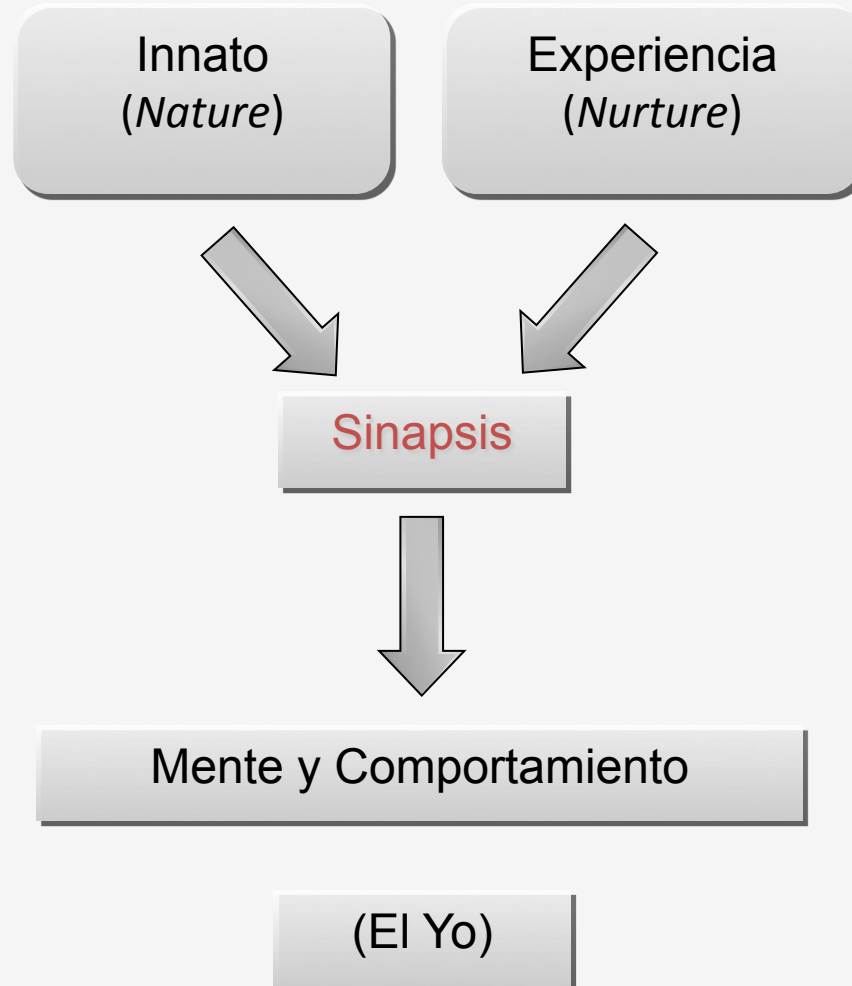
Antibodies for the Neuroscientist
 Biologist
 For more information contact
 sysy.com

Cajal: “Las conexiones sinápticas de las neuronas que median el comportamiento no son fijas sino que se modifican con el aprendizaje, estas conexiones persisten y sirven de componentes elementales de almacenamiento de la memoria”

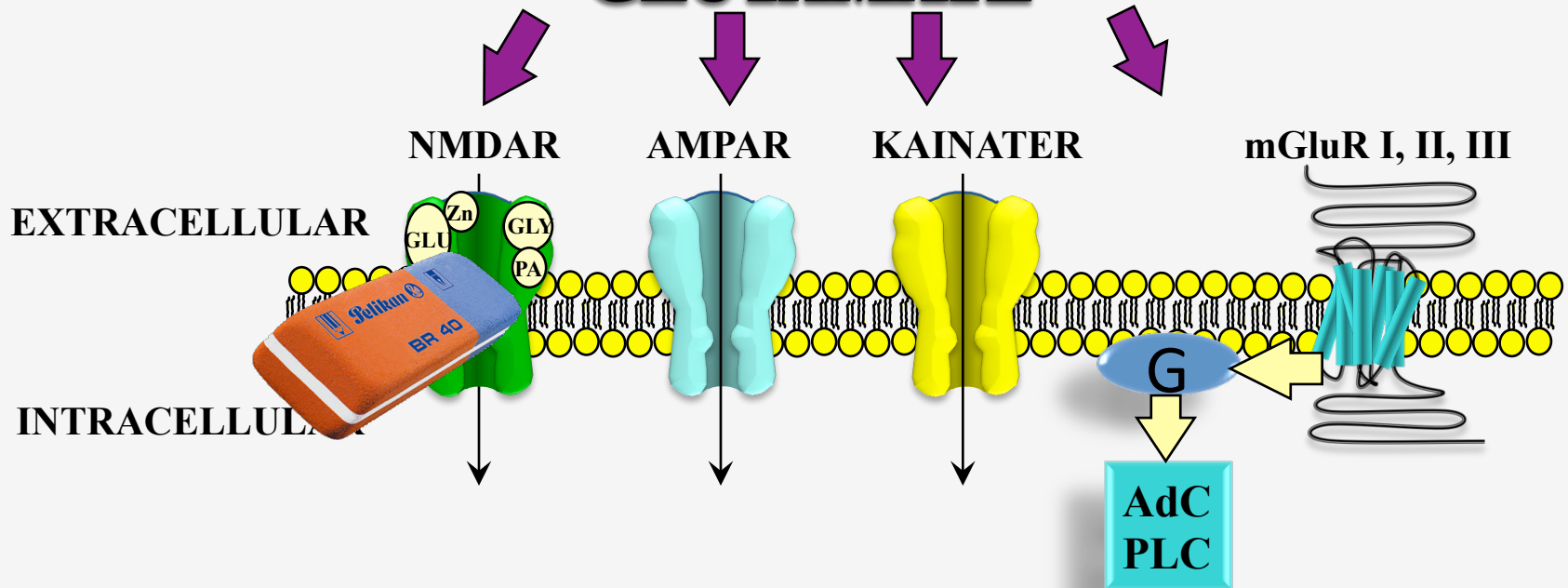


SYSY
 Synaptic

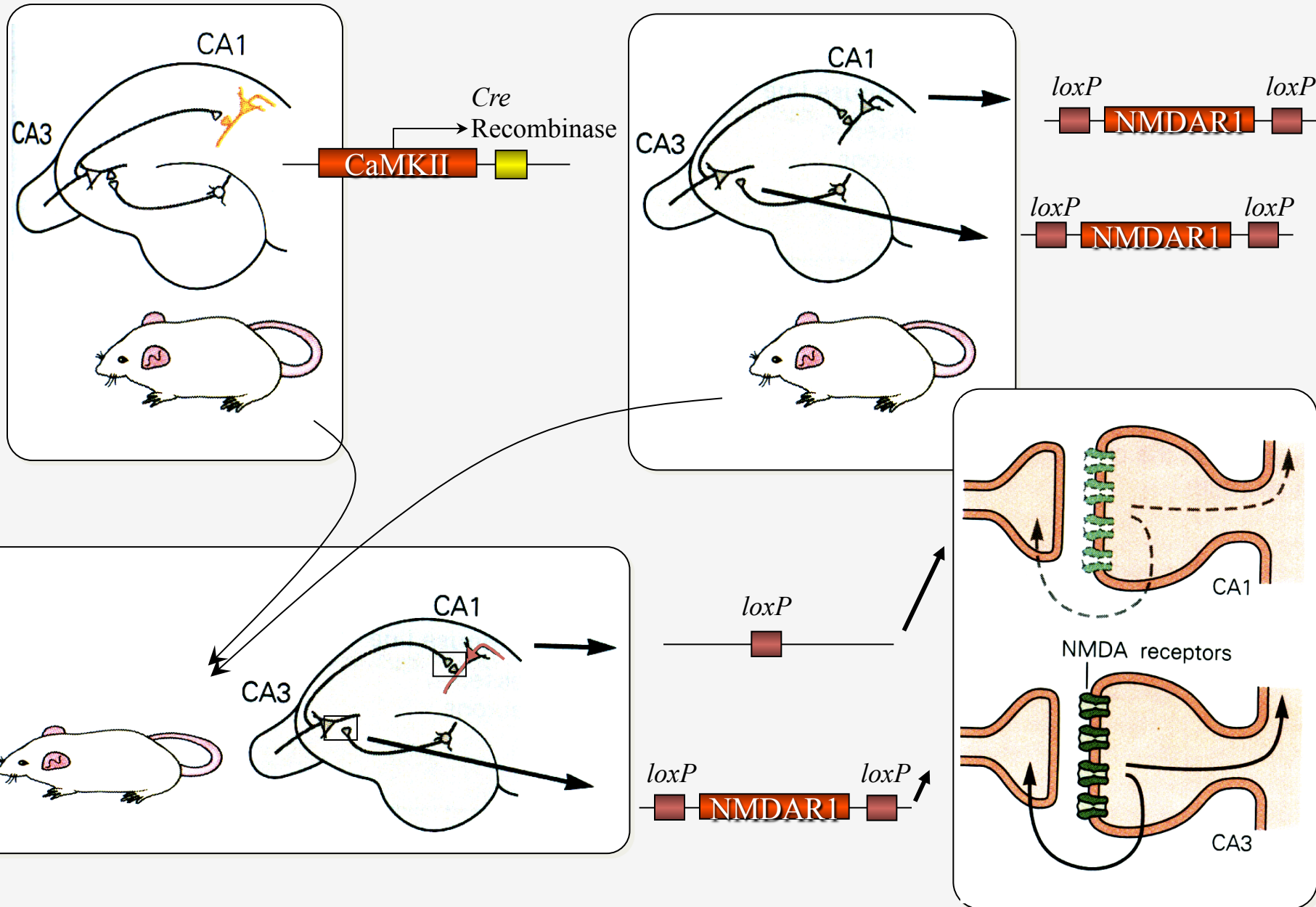




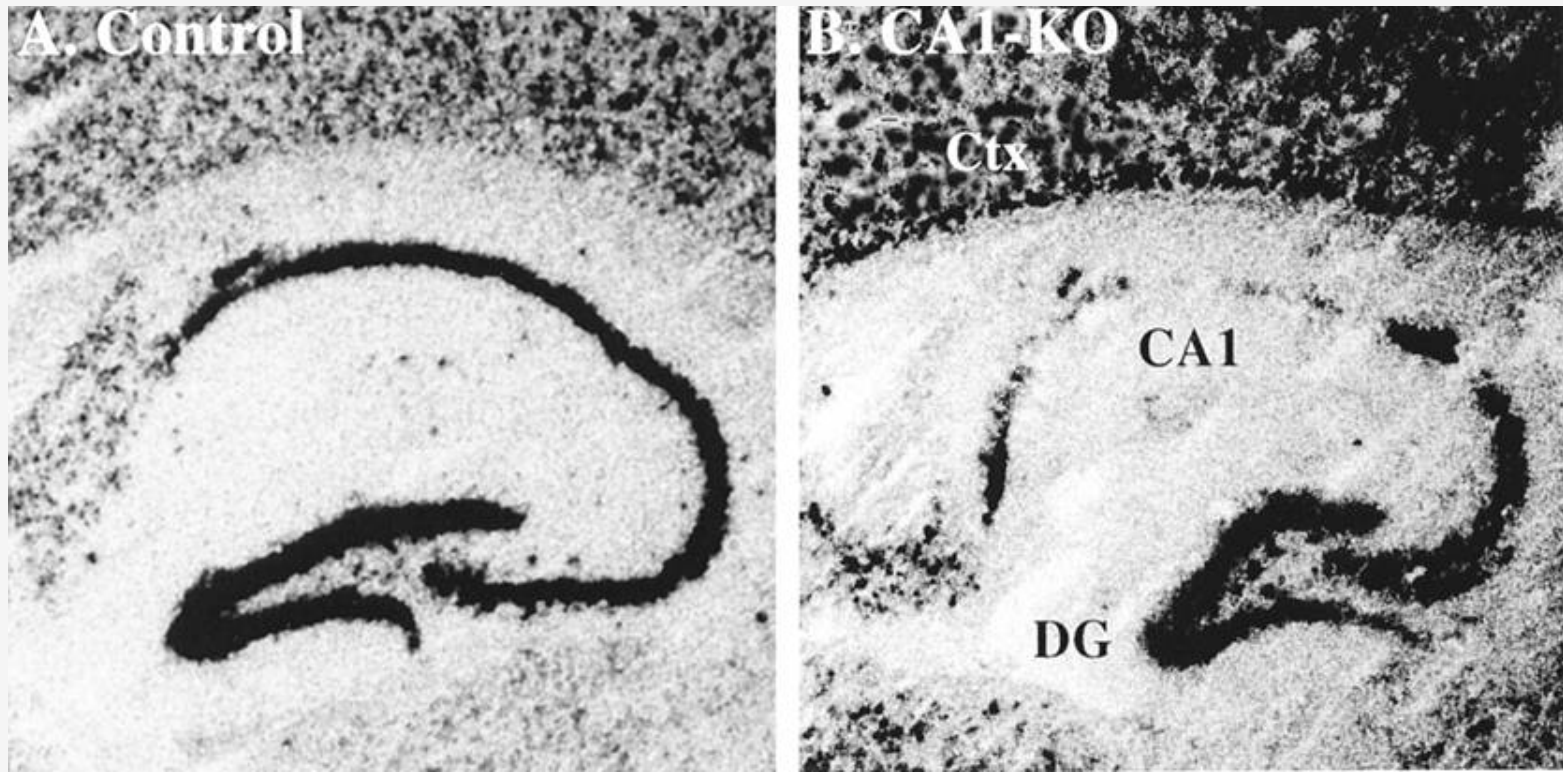
GLUTAMATE

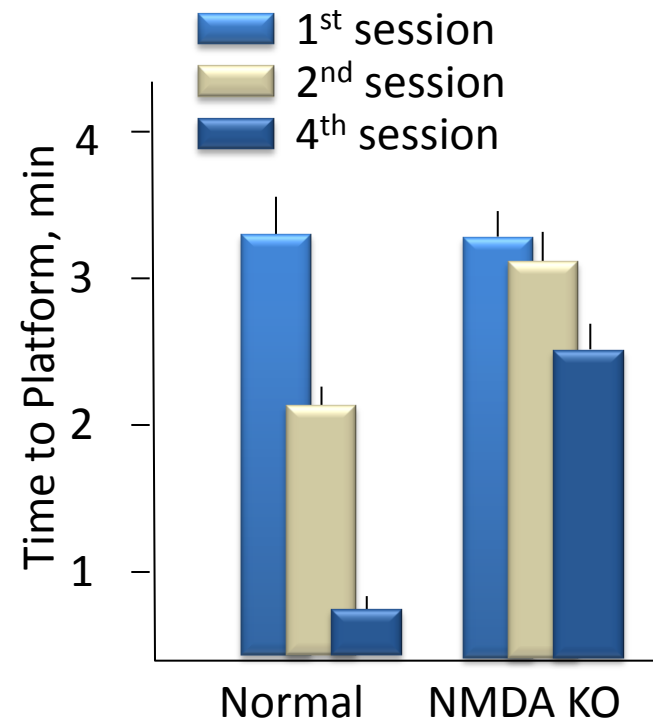
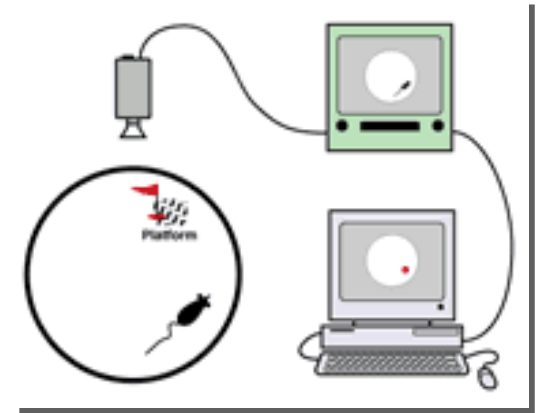


Transgenesis to Uncover Synaptic Protein Function

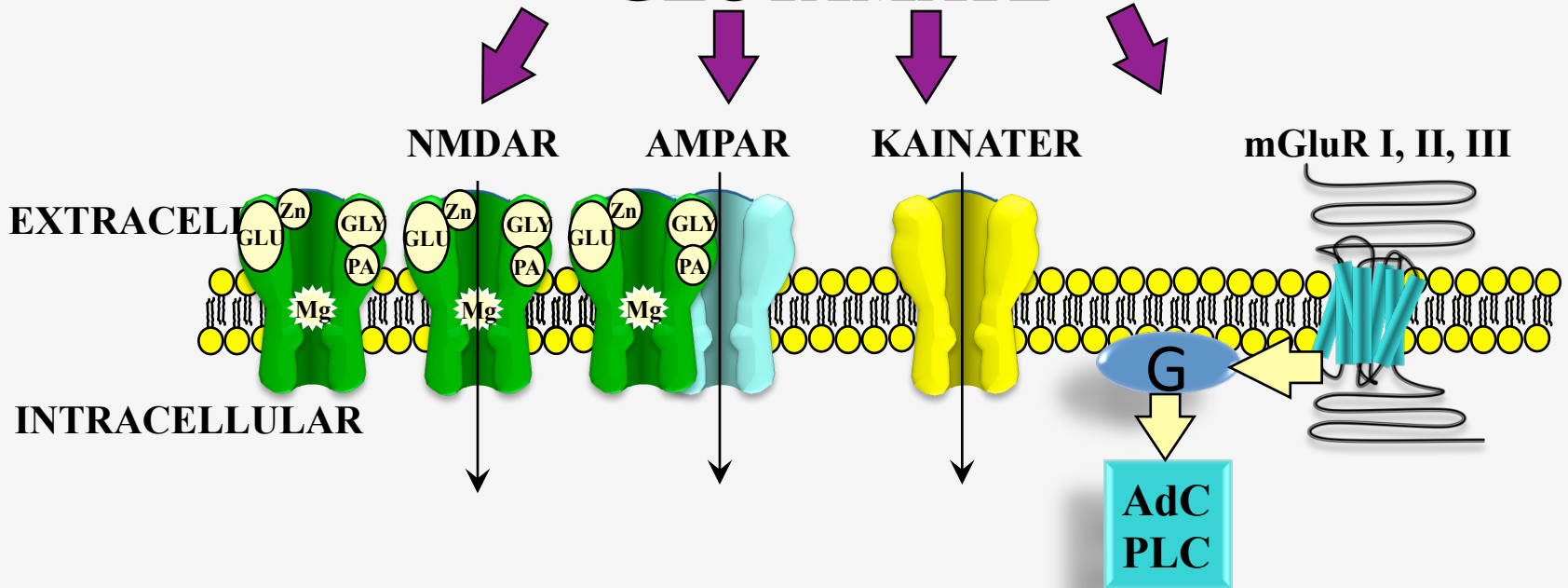


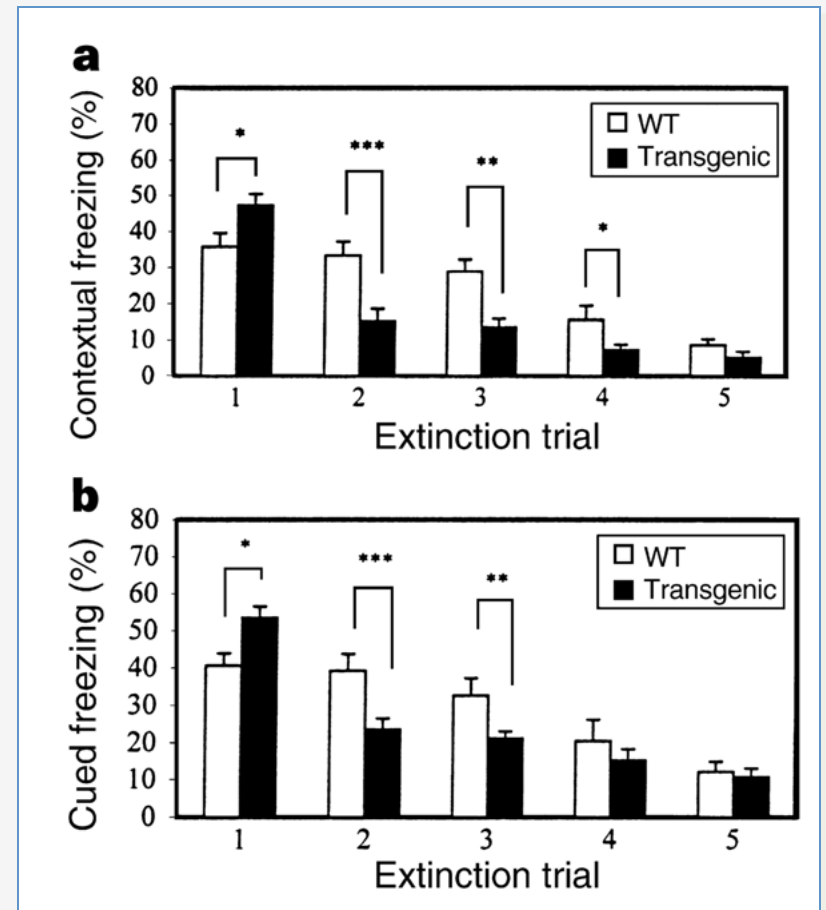
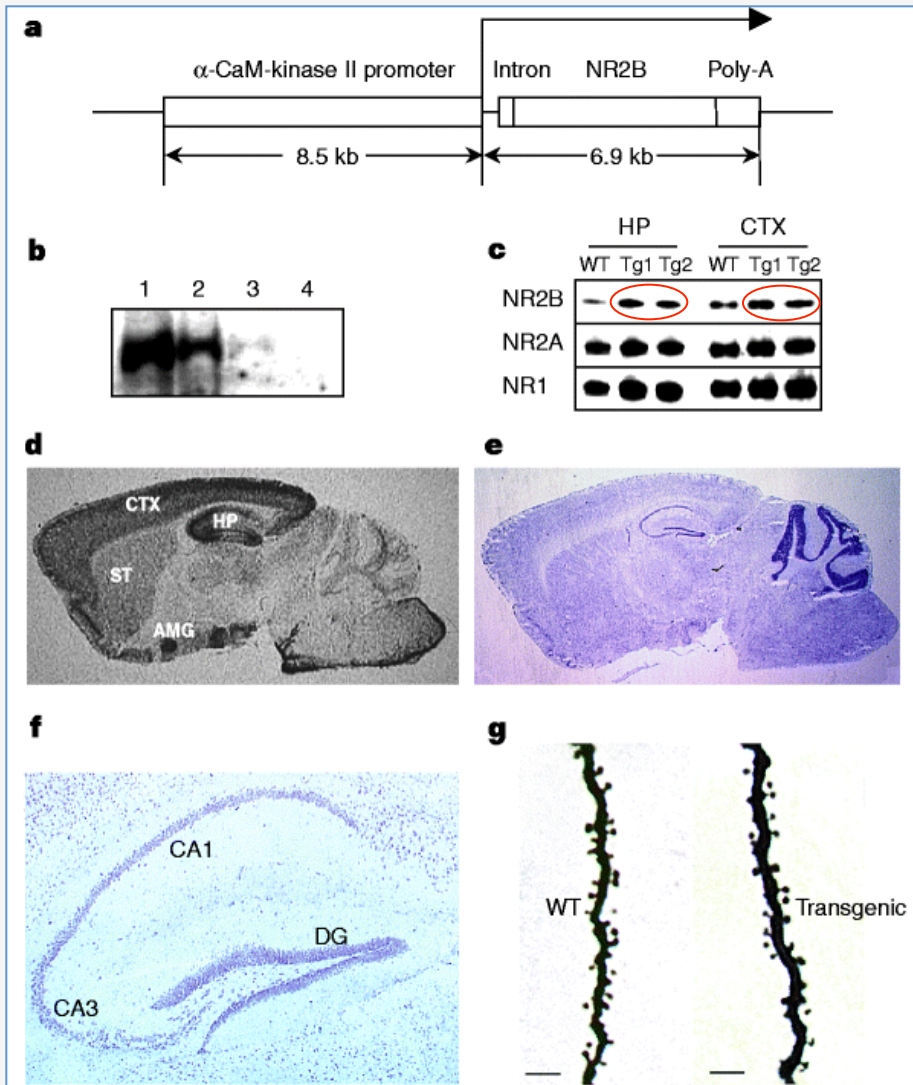
Expression of mRNA for NMDAR1 in the Hippocampus



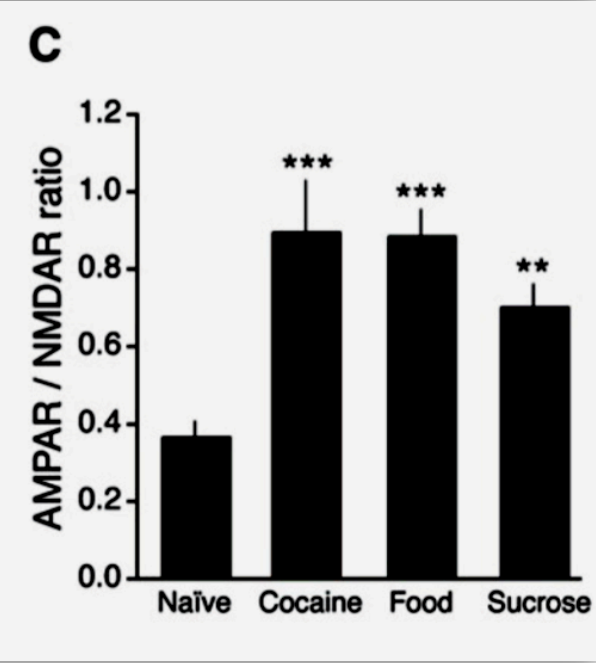
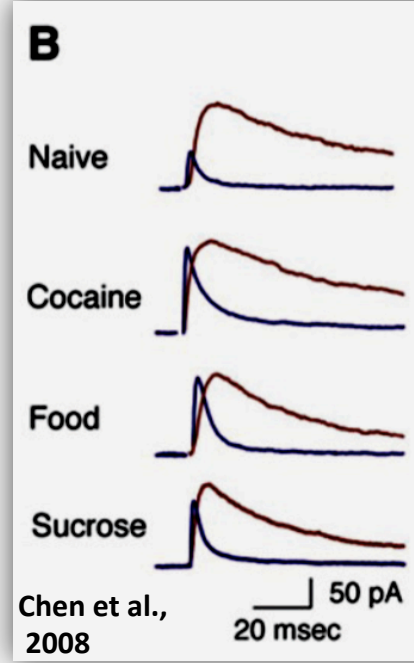
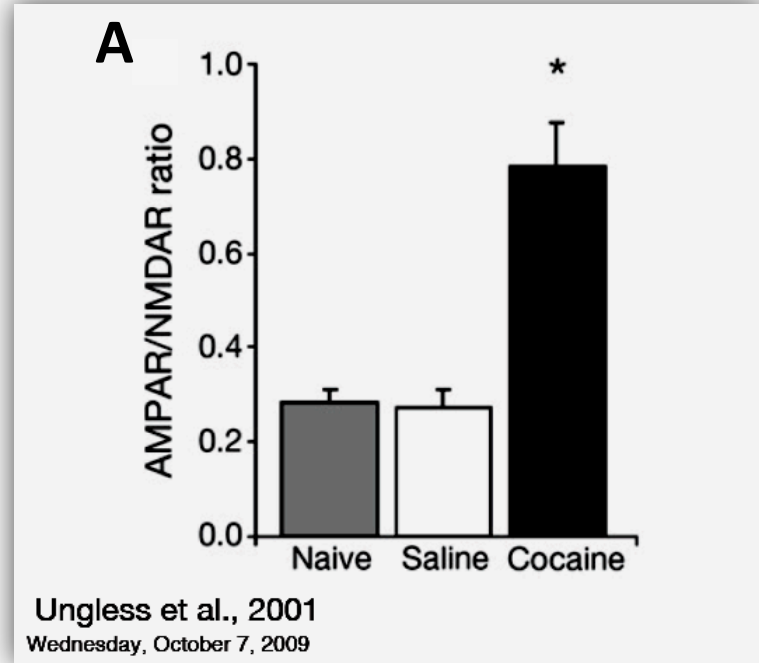
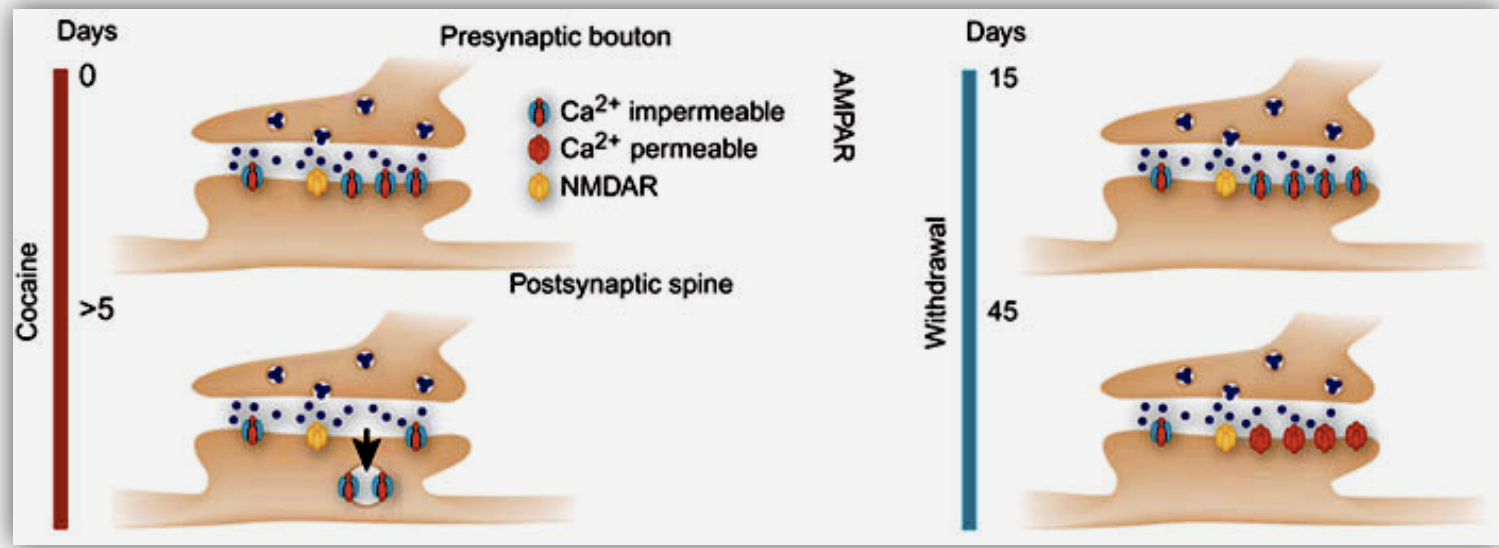


GLUTAMATE





Synapses change their composition for addiction



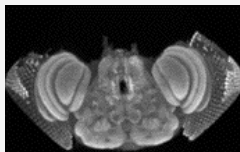
En resumen....

La información se transfiere de una neurona a otra a través de la **sinapsis**. Este proceso esta **finamente regulado**, incluso por la propia actividad neuronal

La desregulación sináptica da lugar a patologías cerebrales severas: **sinaptopatologías**

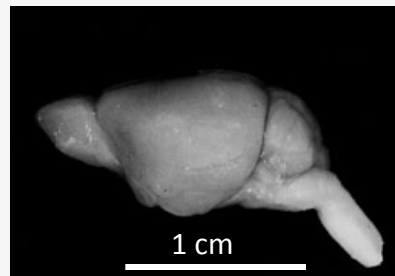
Los mecanismos de neurotransmisión y su plasticidad explican como el SN aprende y representan un **modelo de trabajo** excelente.

Los mecanismos moleculares de la neurotransmisión, el aprendizaje y la memoria **son universales** y legitiman el uso de **modelos animales** para su estudio

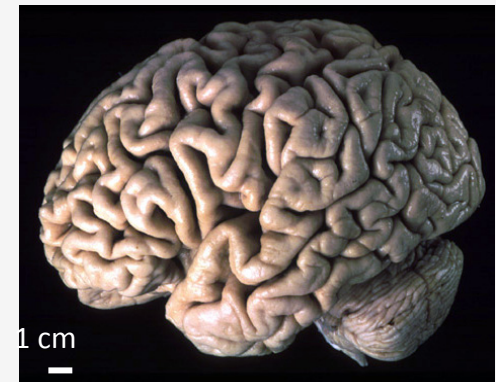


Fly

(X. Sun, <http://www.flybrain.org>)



mouse



human