

Diálogo entre Neurología y Arte: El jardín de la Neurología



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Apollo 11, First Moon Landing
21 July, 1969



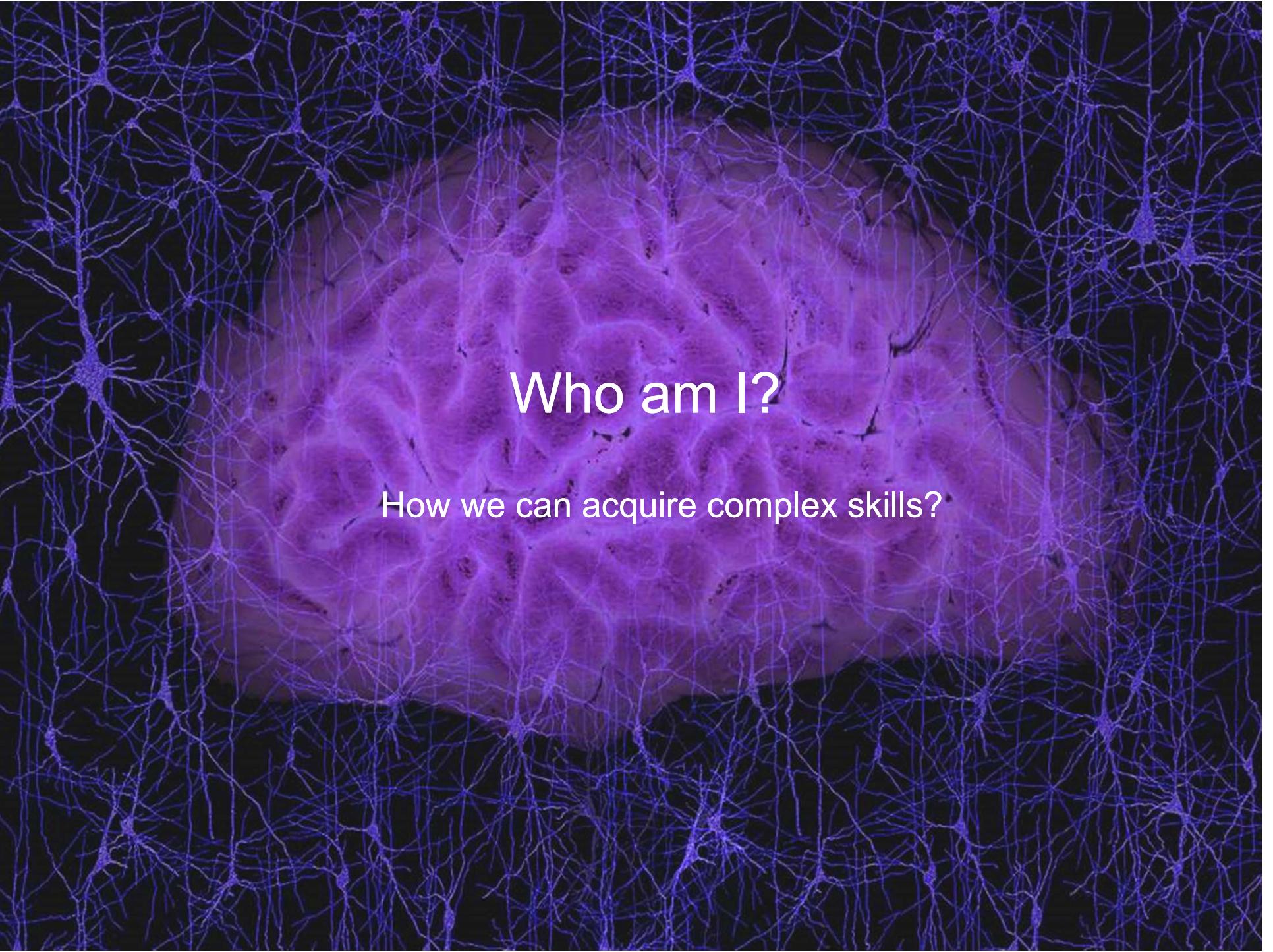
Neil Armstrong
One small step for a man, one giant leap
for mankind



Homo sapiens 200,000 years

How was this possible?

The brain has evolved over millions of years



Who am I?

How we can acquire complex skills?

Altamira Cave Paintings on cave walls
and ceilings: 25.000 years



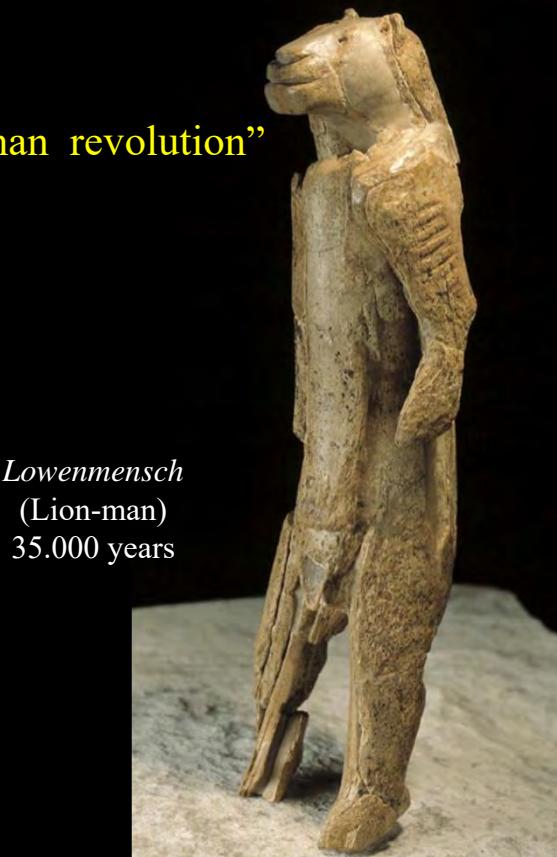
“After Altamira, all is decadence“

Pablo Picasso



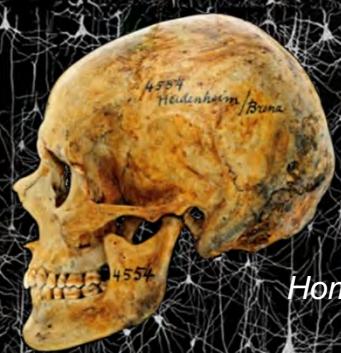
Blombos cave
100.000 years

“The human revolution”



Lowenmensch
(Lion-man)
35.000 years

El bosque neuronal de nuestro cerebro ha permanecido
inalterado por el paso de los siglos y de los milenios



Homo sapiens, 200.000 BP



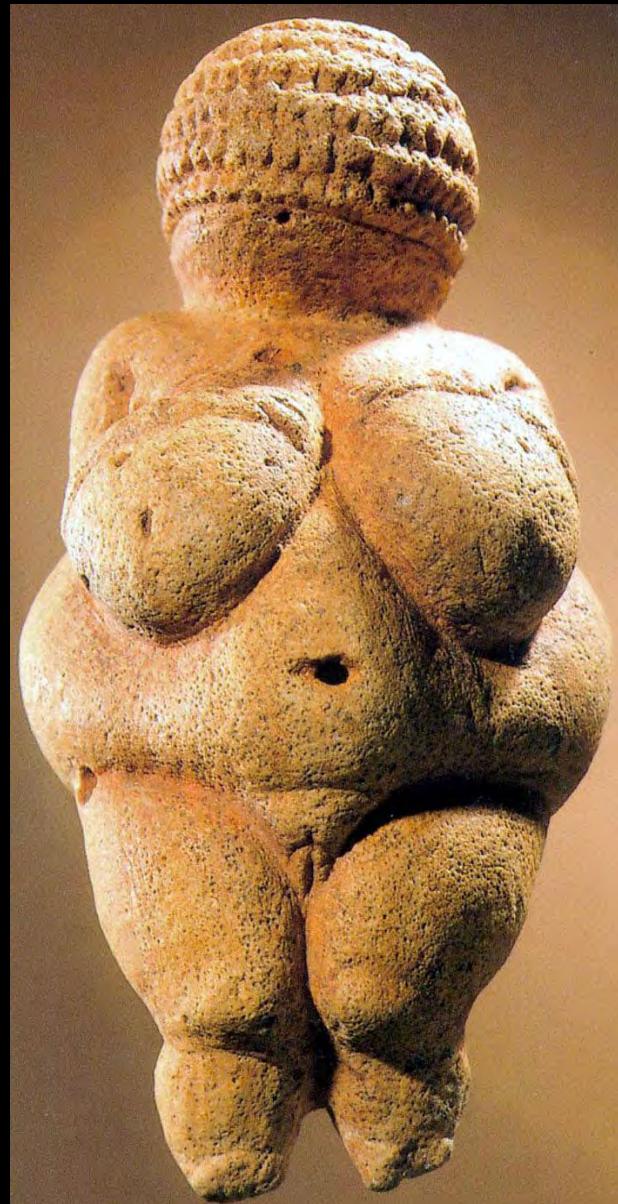
¿Me preguntas por qué compro arroz y flores?

Compro arroz para vivir y flores para tener algo por lo que vivir.

Nuestros antepasados humanos prehistóricos vieron muchos atardeceres y amaneceres y, probablemente, se percataran de la belleza del paisaje, de las flores y de los árboles, pero a pesar de tener un cerebro como el nuestro, todavía no habían desarrollado el lenguaje y menos aún la escritura, por lo que no pudieron disfrutar intelectualmente del arte de la literatura.

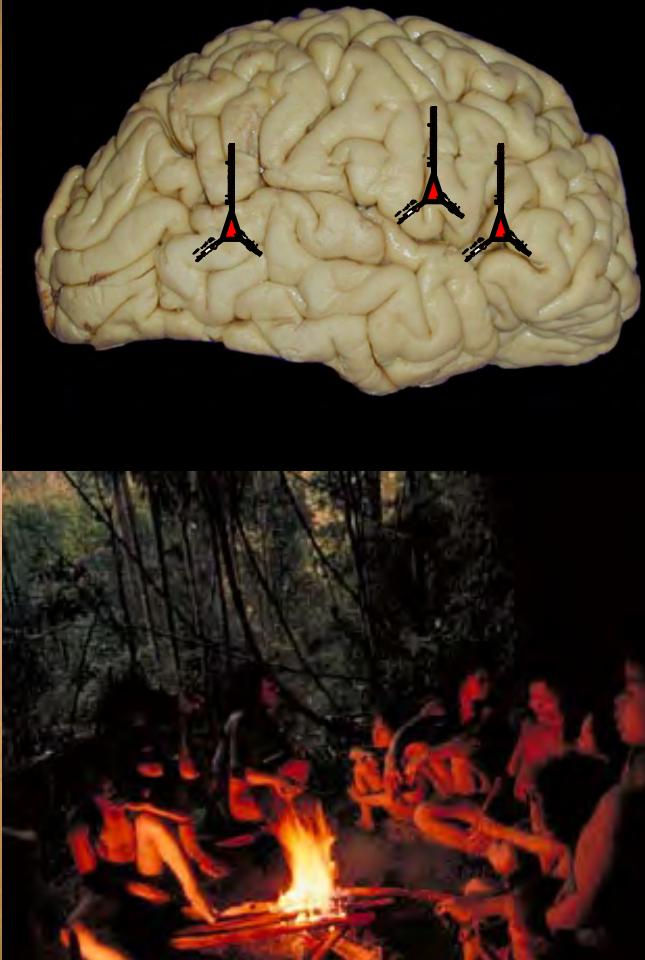
D&Felipe J (2011) *The evolution of the brain, the human nature of cortical circuits and intellectual creativity*. *Front. Neuroanat.* 5:29.

The Venus of Willendorf
25,000 BCE



Desarrollo de la creatividad artística

Mirror neurons discharge with both action observation and action execution. It has been proposed that the mirror neuron system is instrumental in motor learning



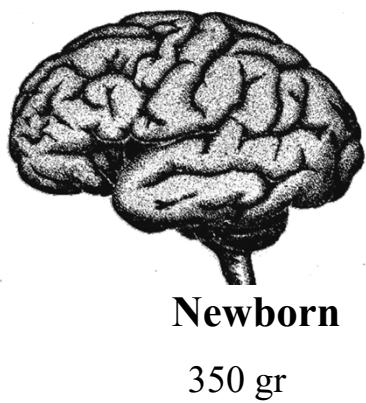
David from Michelangelo
1475-1564



Mi sono
innamorato
di una statua
(Stendhal)

started in 1501 and completed in 1504

Nacemos con un cerebro completamente limpio de ideas.

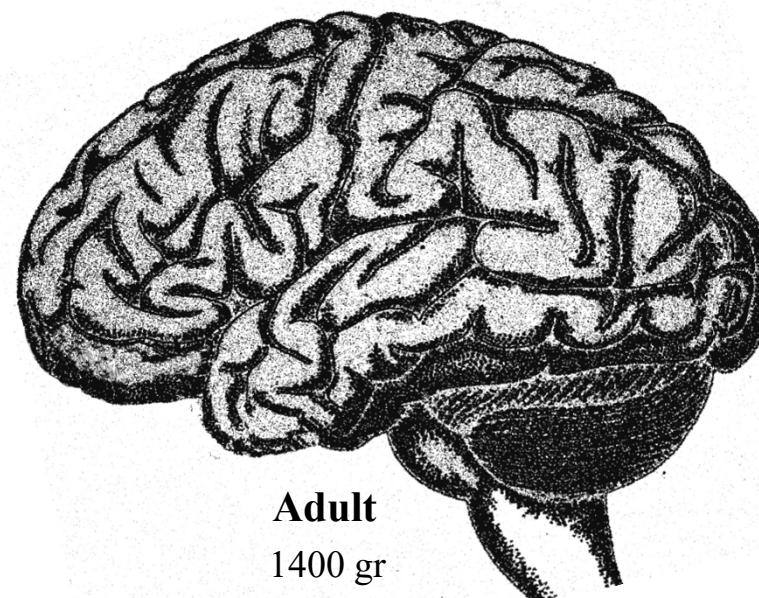


Newborn

350 gr

4 x increase

Maturation mental processes and motor skills



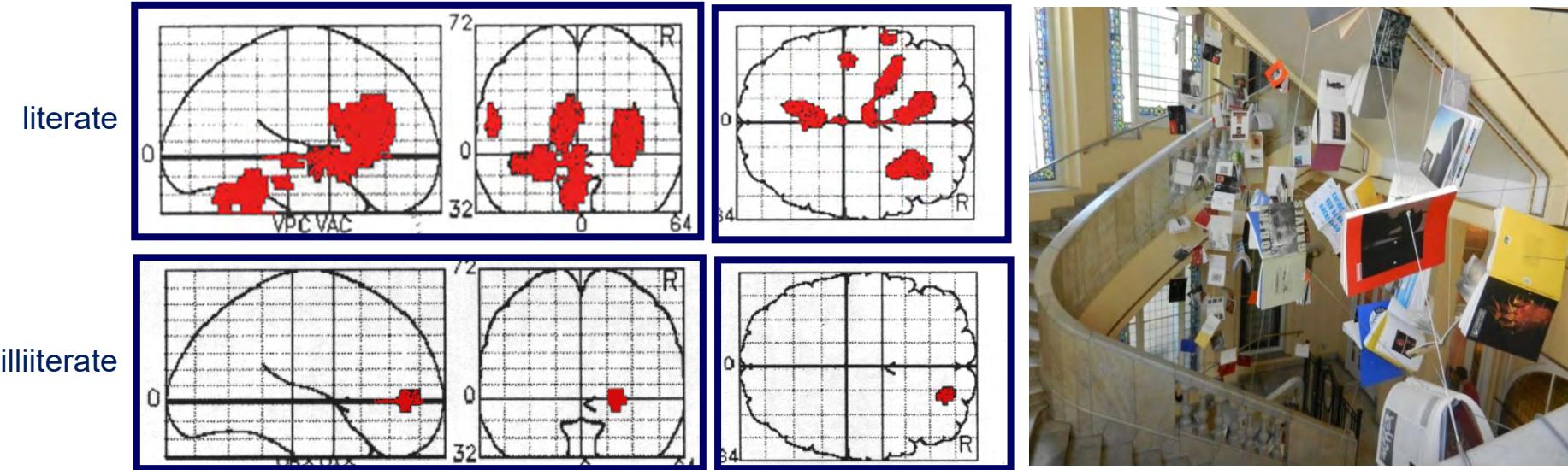
Adult

1400 gr



Exponential increase in synaptic density during development

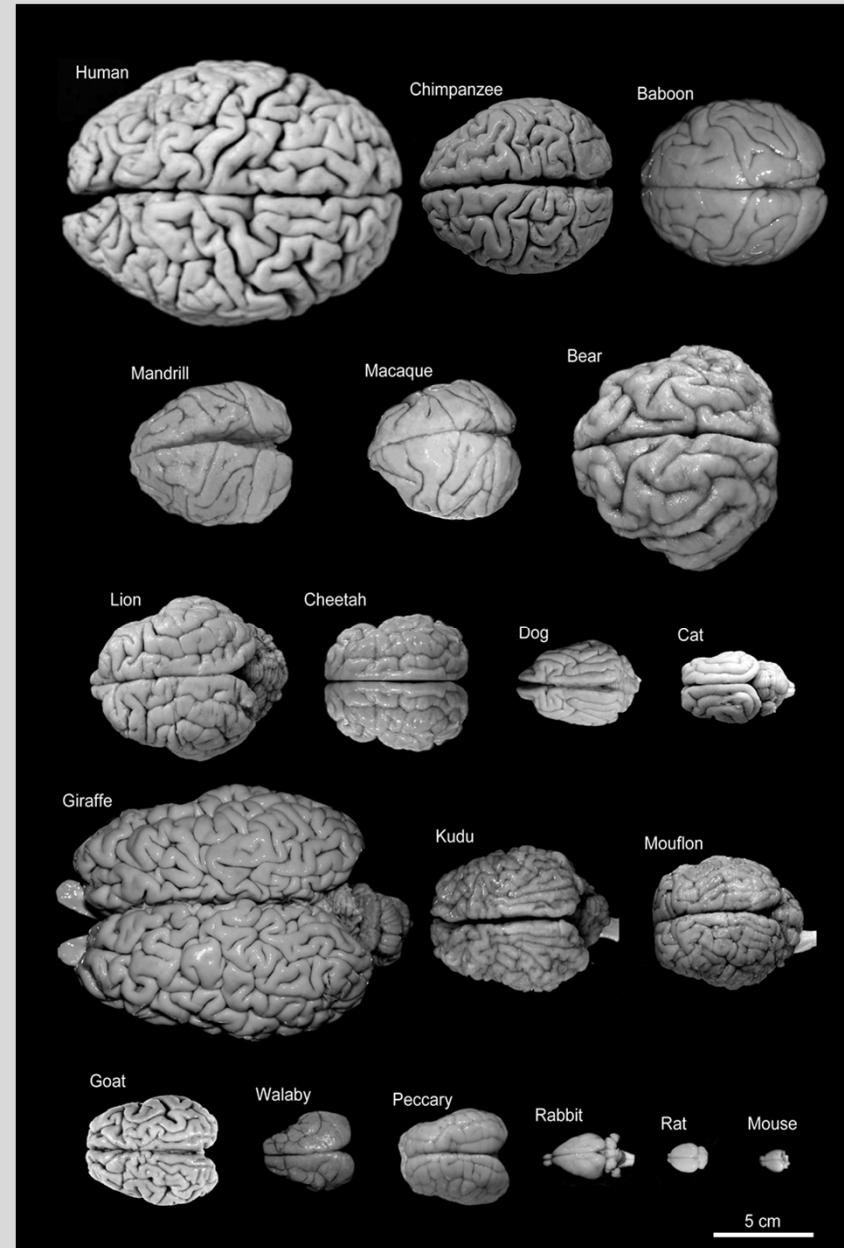
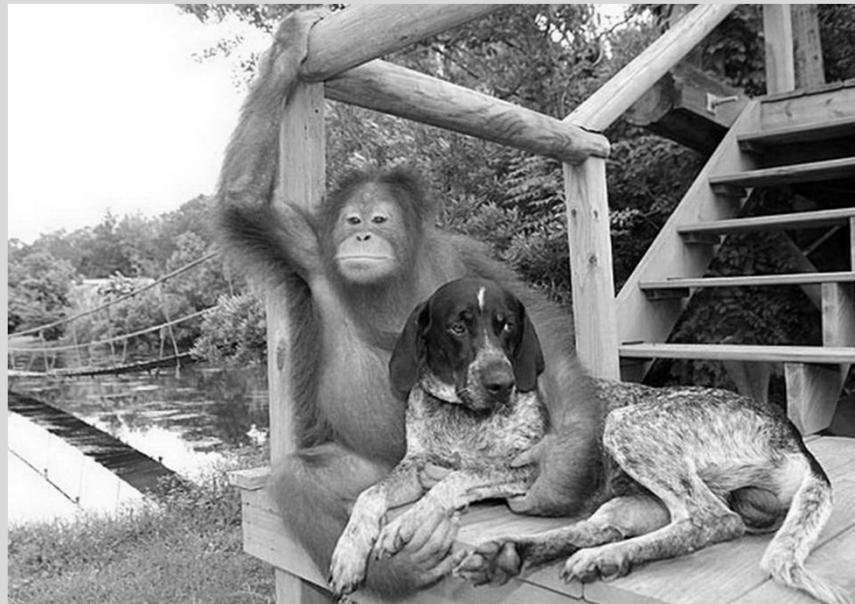
Brain activation: Regional cerebral blood flow (PET)



Conclusion: Culture changes the brain, and that learning to read changes the way speech is processed.

Castro-Caldas A, Petersson KM, Reis A, Stone-Elander S, Ingvar M (1998) The illiterate brain. Learning to read and write during childhood influences the functional organization of the adult brain. *Brain* 121:1053-1063.

El gran enigma de los otros mundos mentales, tan distintos y a la vez tan similares





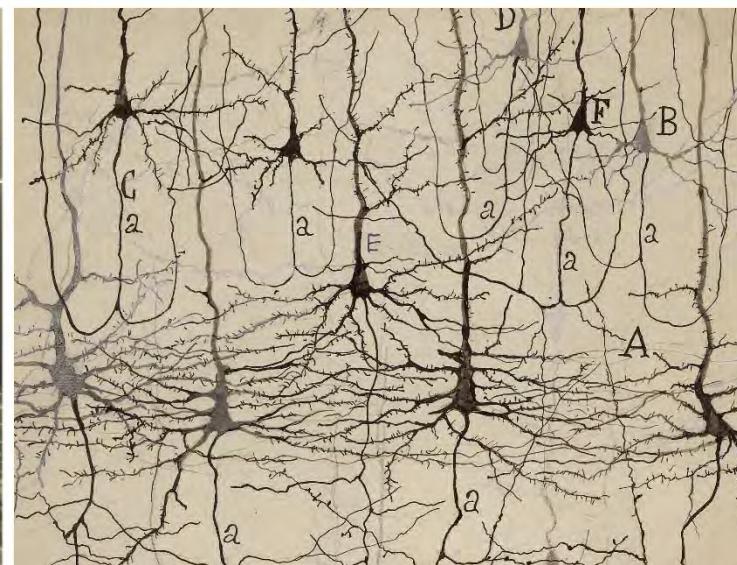
¿Qué tiene de especial la neocorteza humana y en qué se diferencia de la de otras especies?

Ciencia y Arte

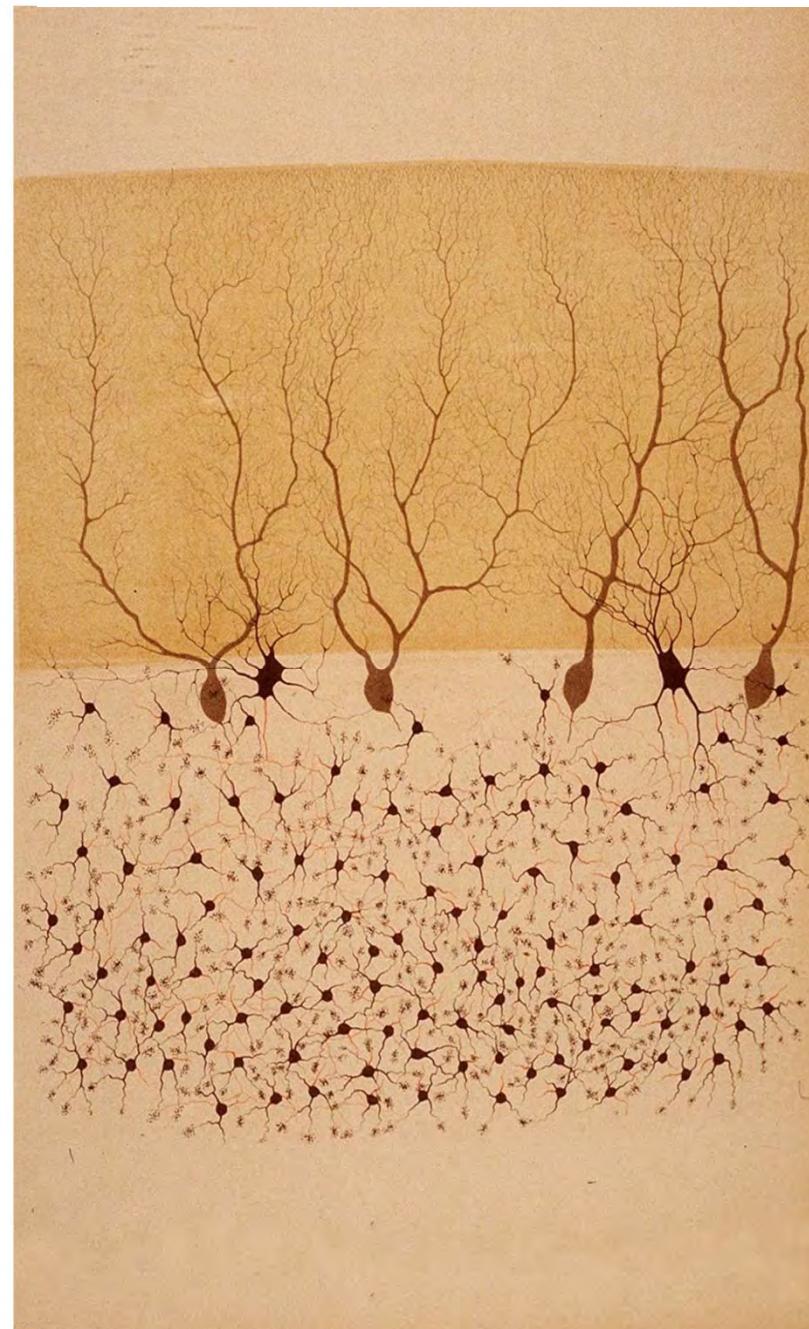


Creatividad artística de nuestro cerebro y la belleza natural de sus paisajes neuronales

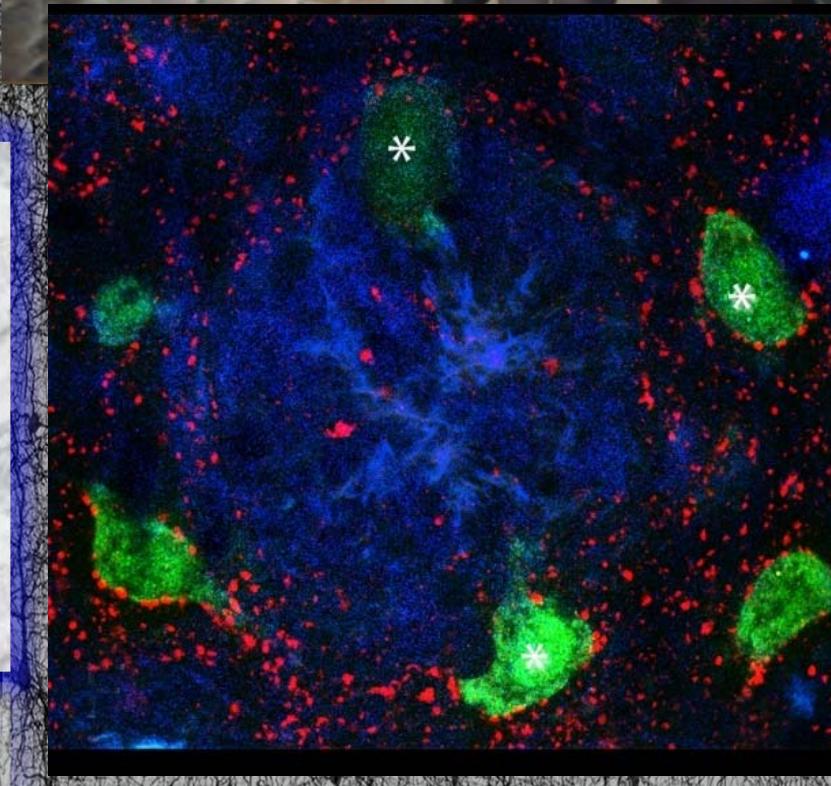
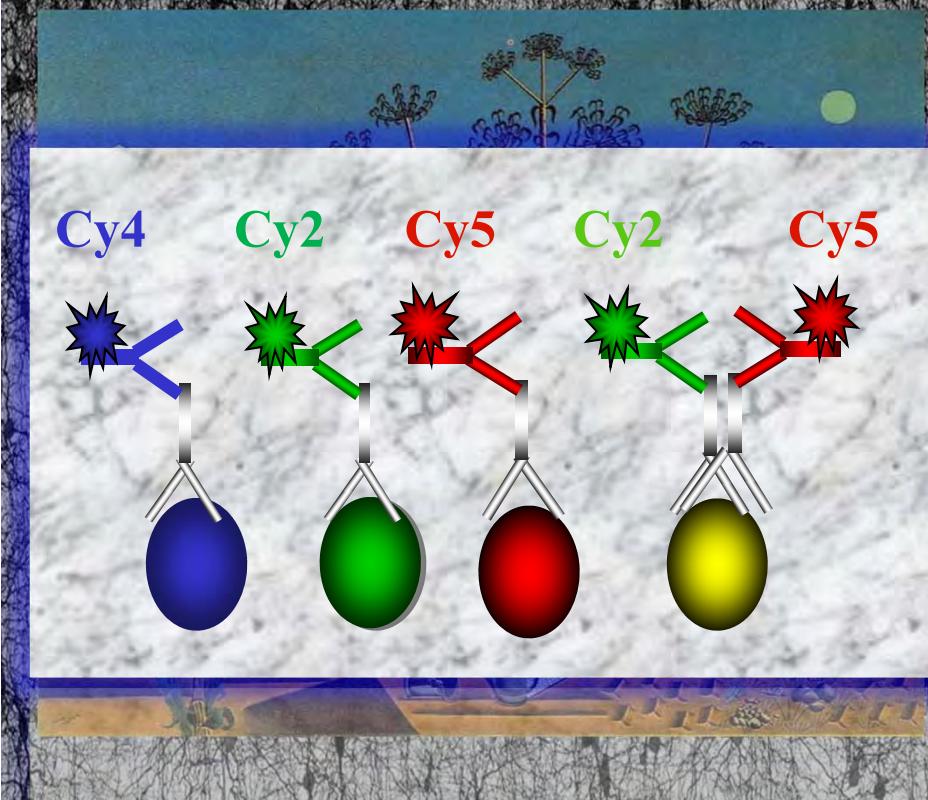
Science and Art: The golden era for artistic creativity in neuroscience



Most of the scientific illustrations of the early neuroanatomists were their own drawings

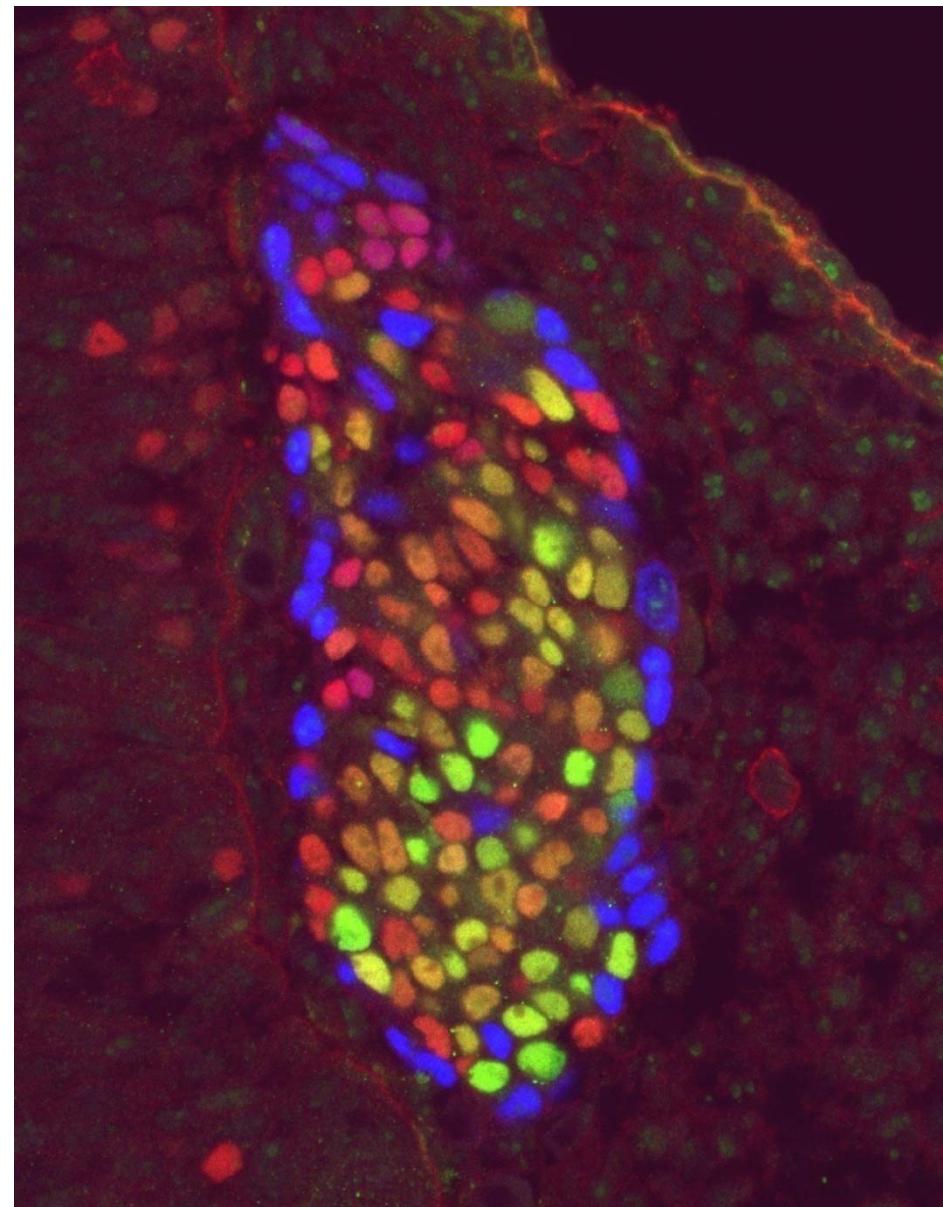


Beauties of the brain





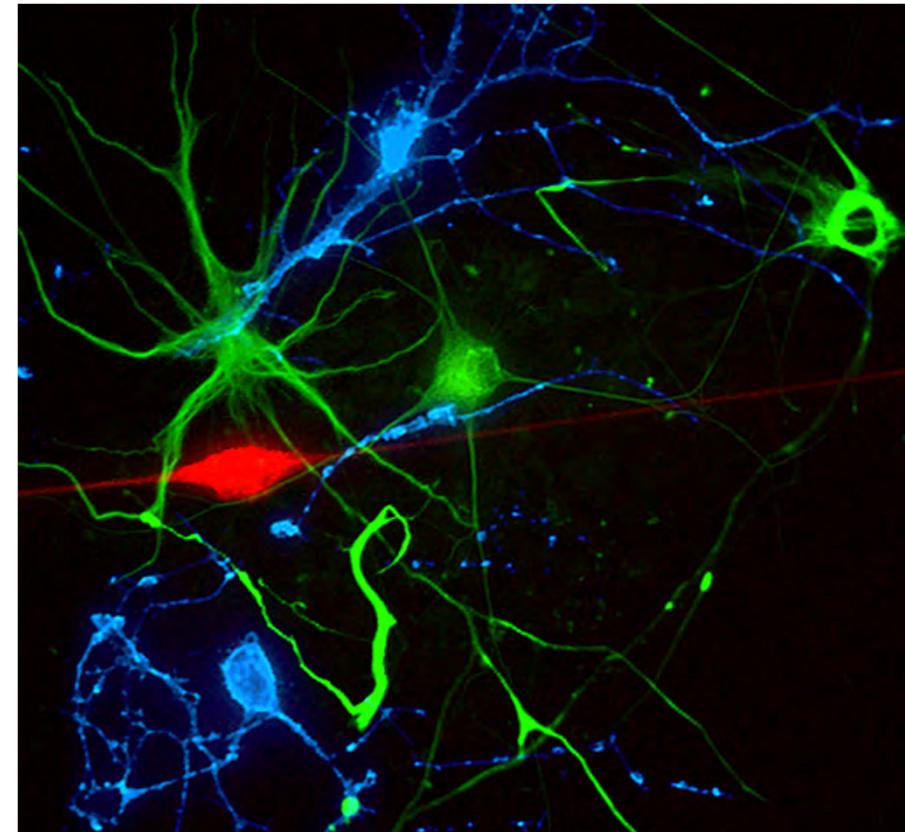
Marc Chagall (1887-1985)
The dreamer



Andreas Montelius *et al.*
Paisajes Neuronales, 2007

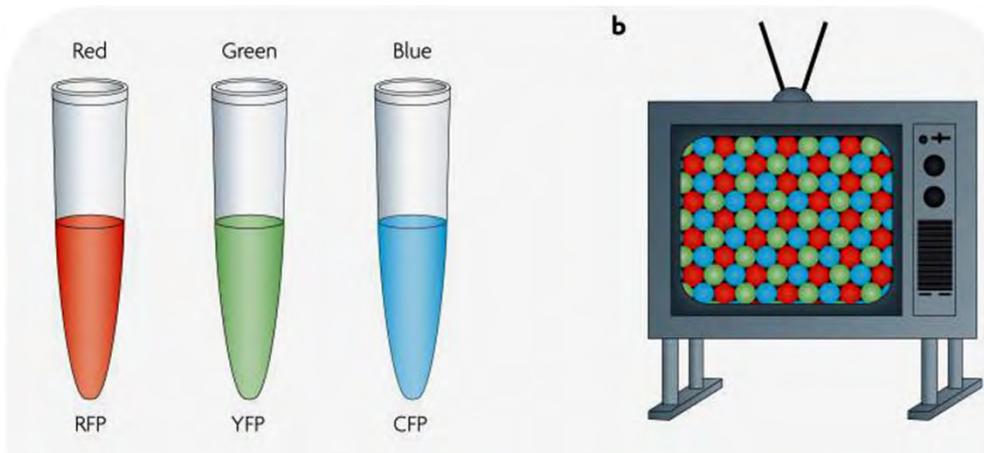


Joan Miró (1893-1983)



Verdugo et al
Paisajes Neuronales, 2007

Multicolour neuronal labelling in Brainbow transgenic mice

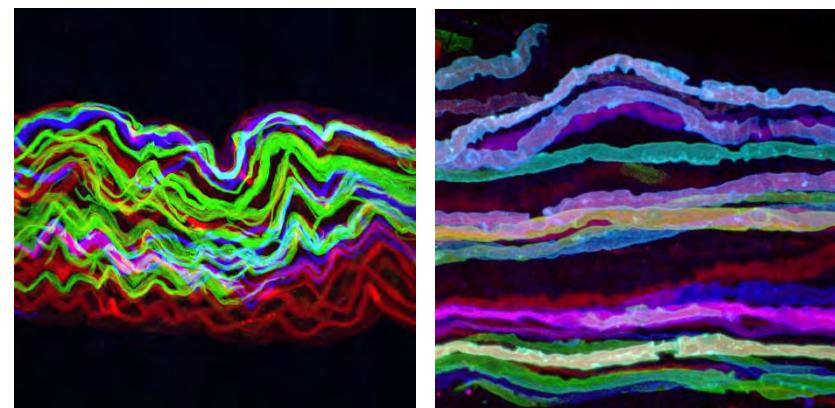
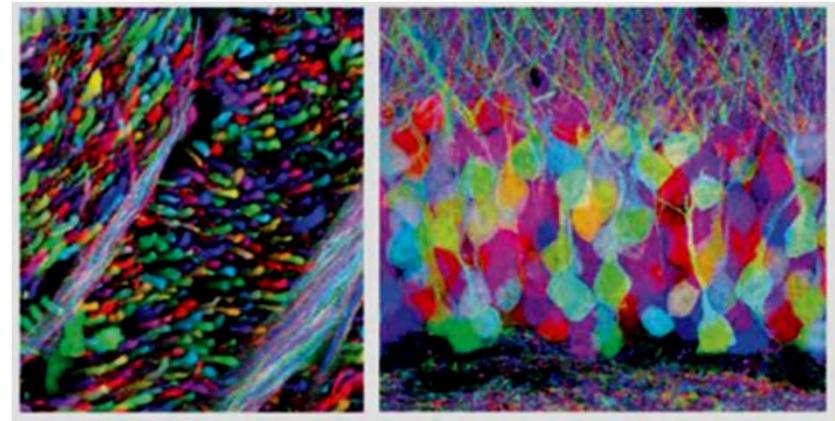


CFP	CFP	CFP
CFP	CFP	YFP
CFP	YFP	YFP
YFP	YFP	YFP
YFP	YFP	RFP
YFP	RFP	RFP
RFP	RFP	RFP
RFP	RFP	CFP
RFP	CFP	CFP
RFP	CFP	YFP

Resulting colour

Ergebnis farbe
Resulting color

Ergebnis farbe
Resulting color



Combinatorial expression of three distinct fluorescent proteins can generate a large spectrum of colours

a | several spectrally distinct fluorescent proteins (XFPs) are now available, including ones that emit in red (RFP), green (YFP) and blue (CFP) frequencies. b | The combinatorial expression of red, green and blue XFPs at various levels is sufficient to encode a colour space analogous to the one that is generated by an RGB video monitor.





Vasili Kandisky, 1866-1944



Pablo Picasso, 1881-1973



Vasili Kandisky, 1866-1944



Franz Marc, 1880-1916



Pablo Picasso, 1881-1973



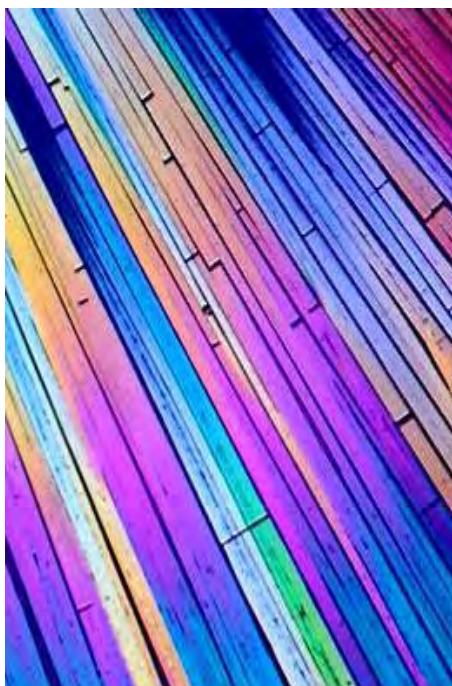
Franz Marc, 1880-1916



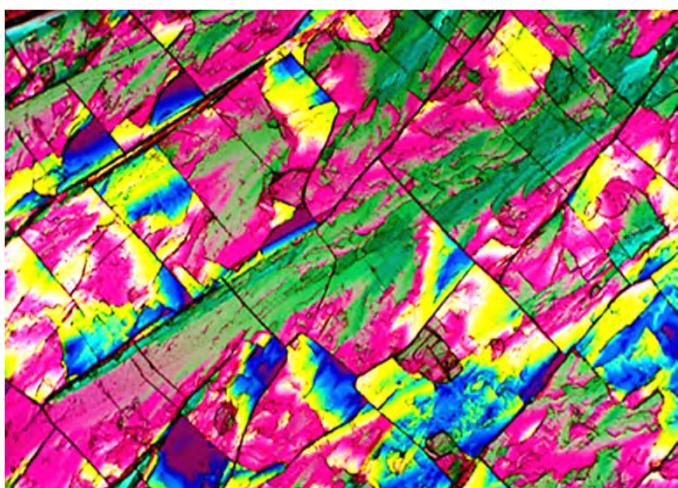
Juan Gris (1887-1927)



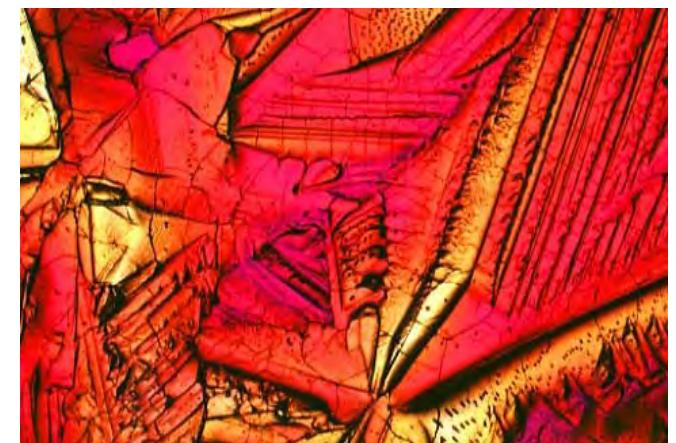
Glutamic acid



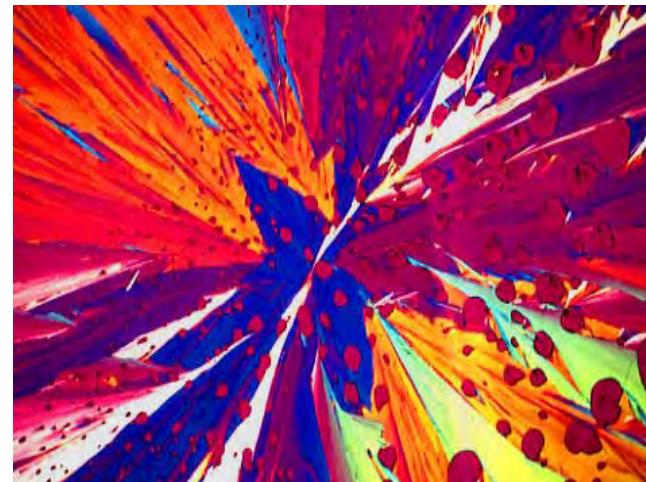
Acetylcholine



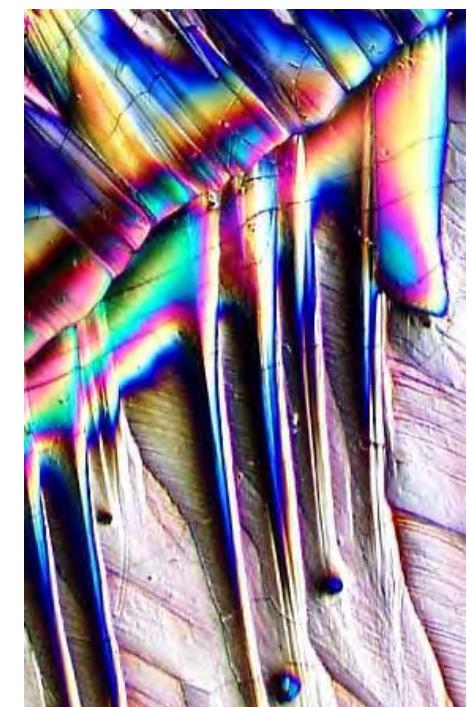
GABA



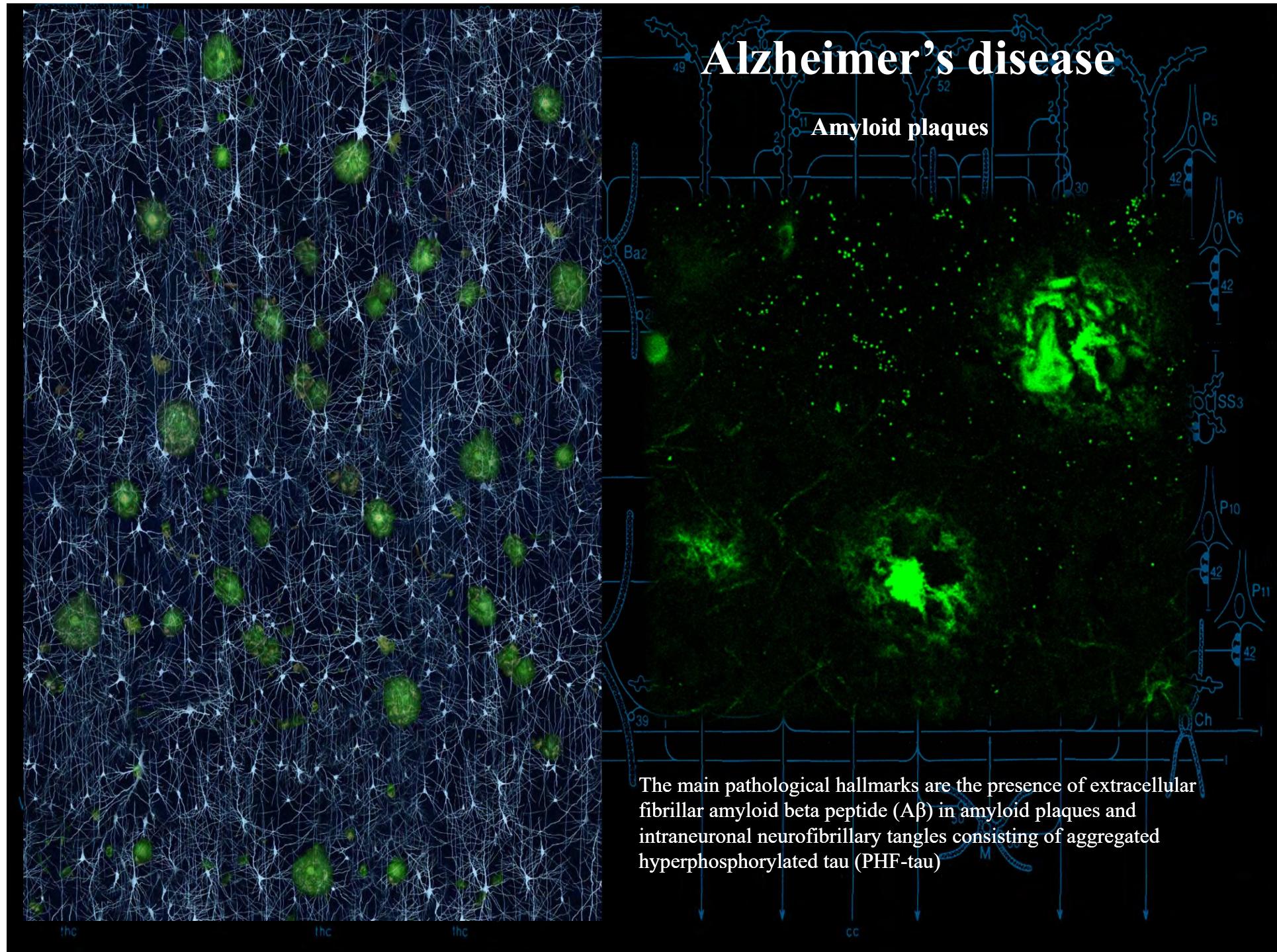
Serotonin

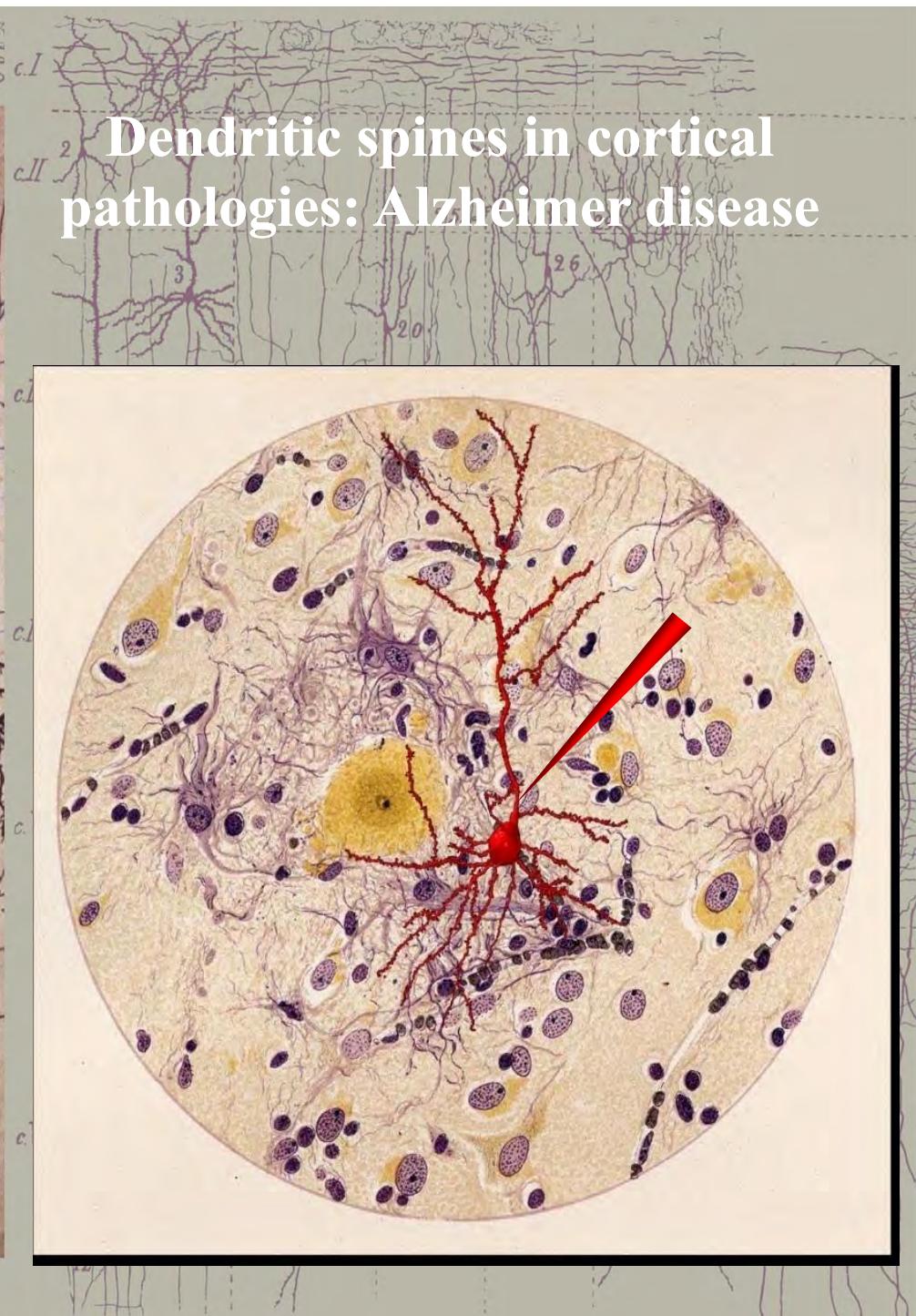


Dopamin

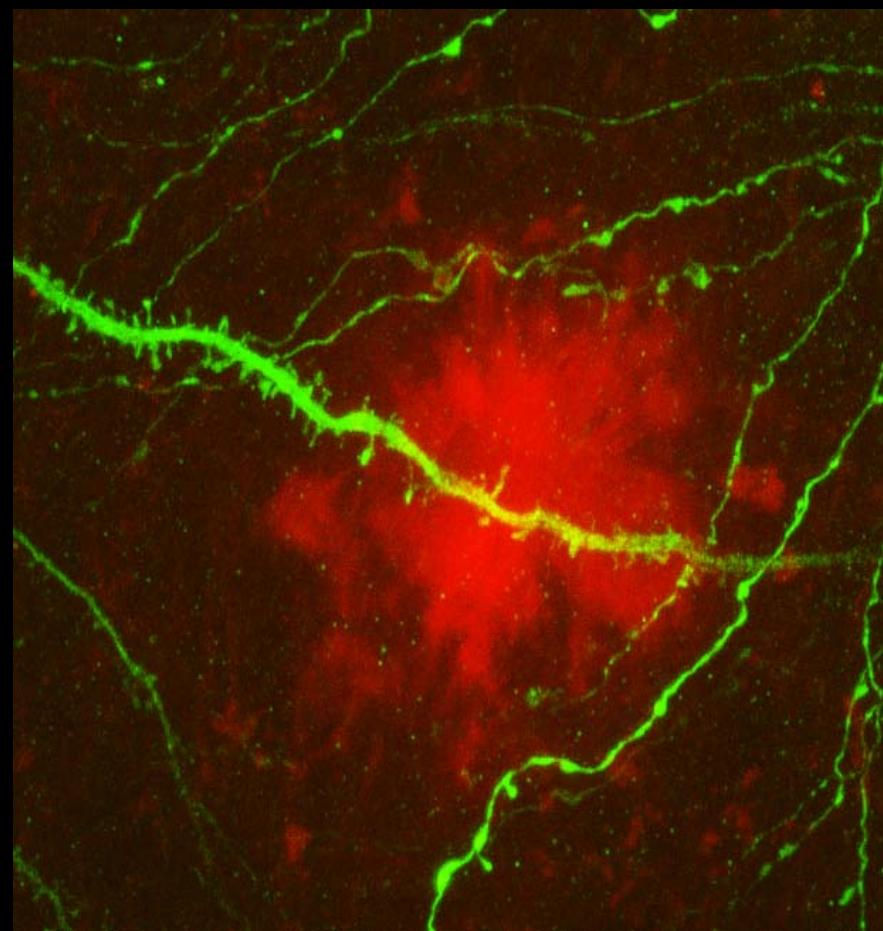
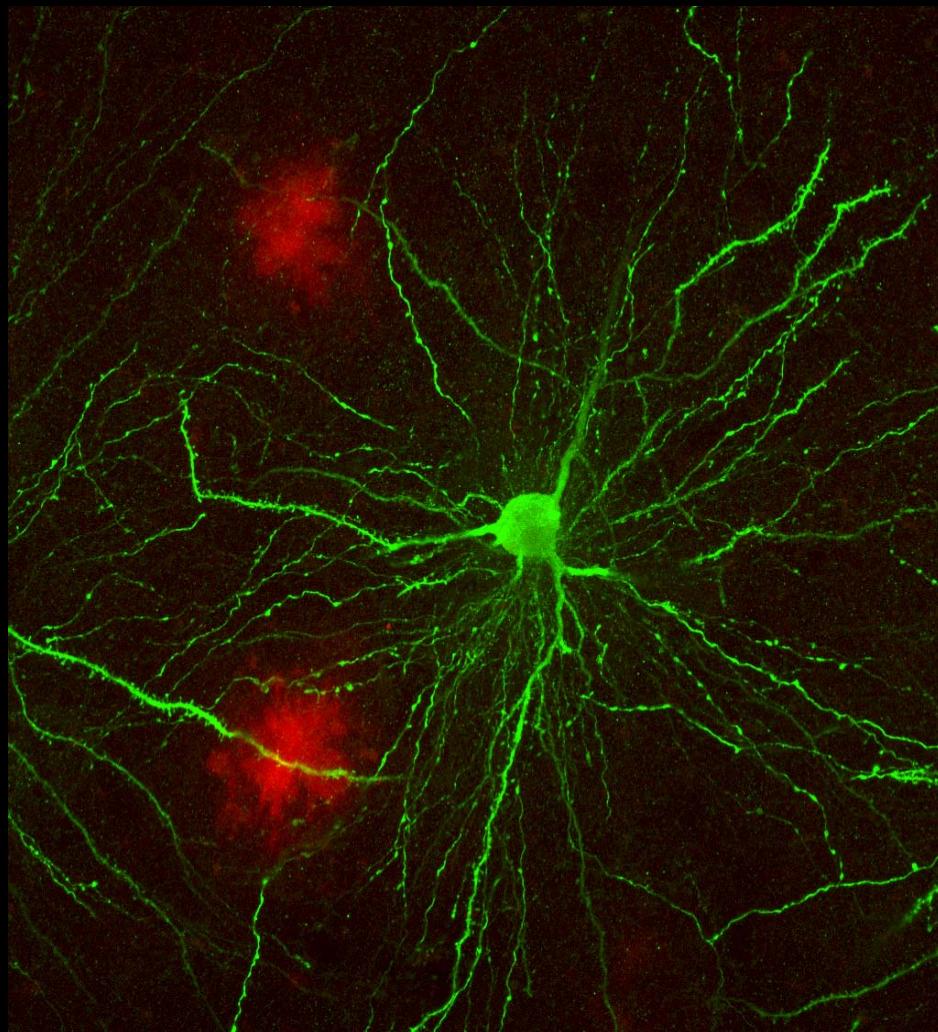


Norepinephrine





Dendritic spines in cortical pathologies: Alzheimer disease

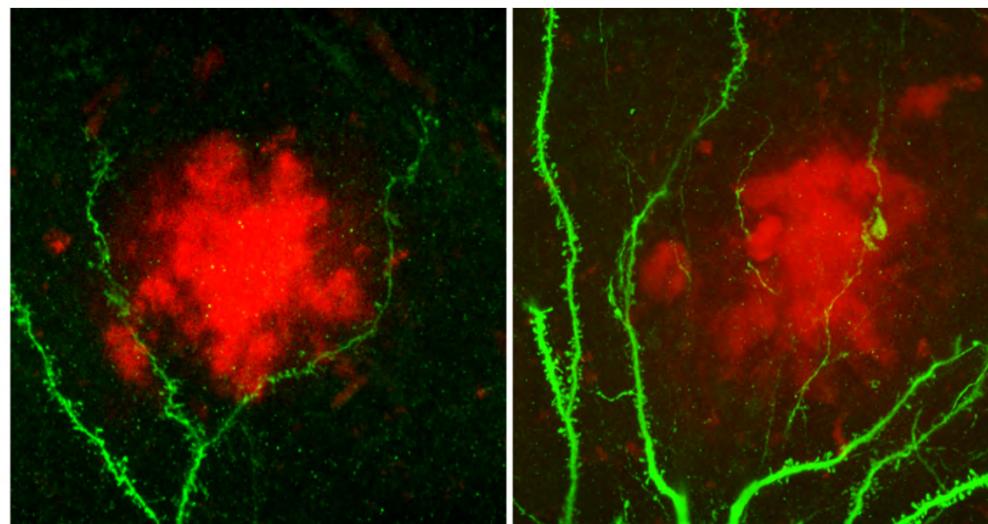


Sobre el parecido entre el arte que crea nuestro cerebro y la belleza natural de sus paisajes neuronales

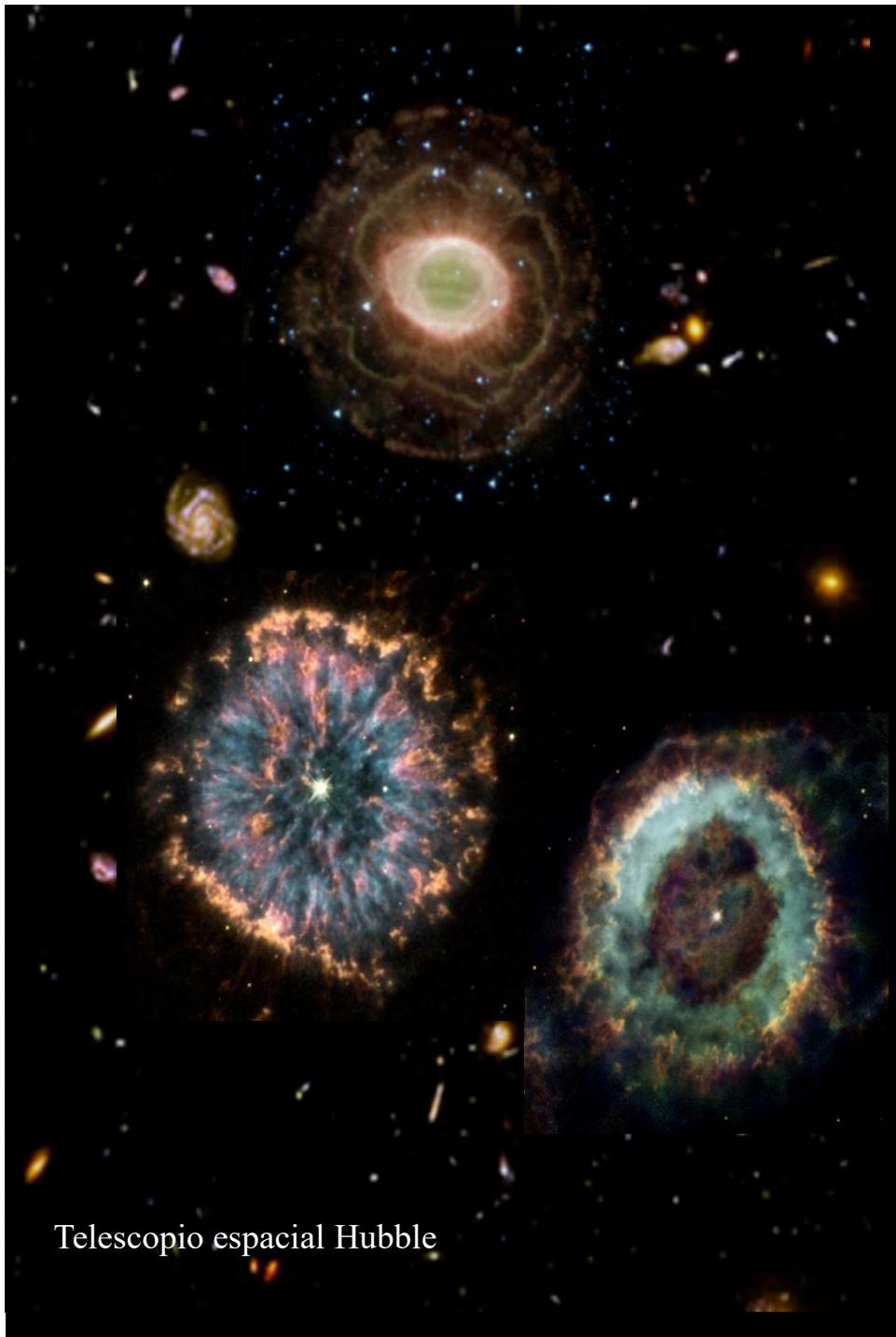


Cristóbal Guerra.
Los códices del vino
(CICCA Las Palmas de Gran
Canaria, 2009).

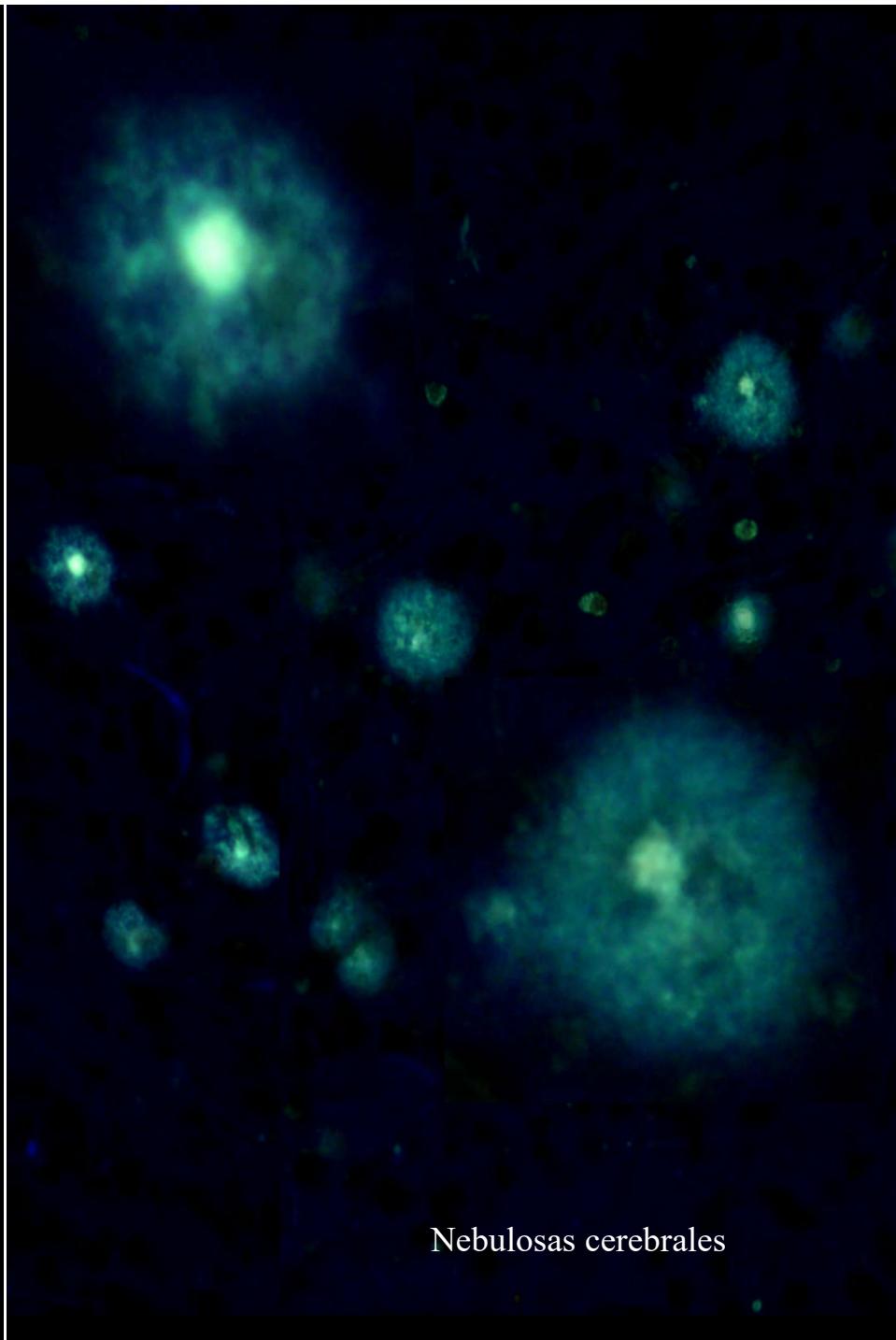
vides



placas seniles

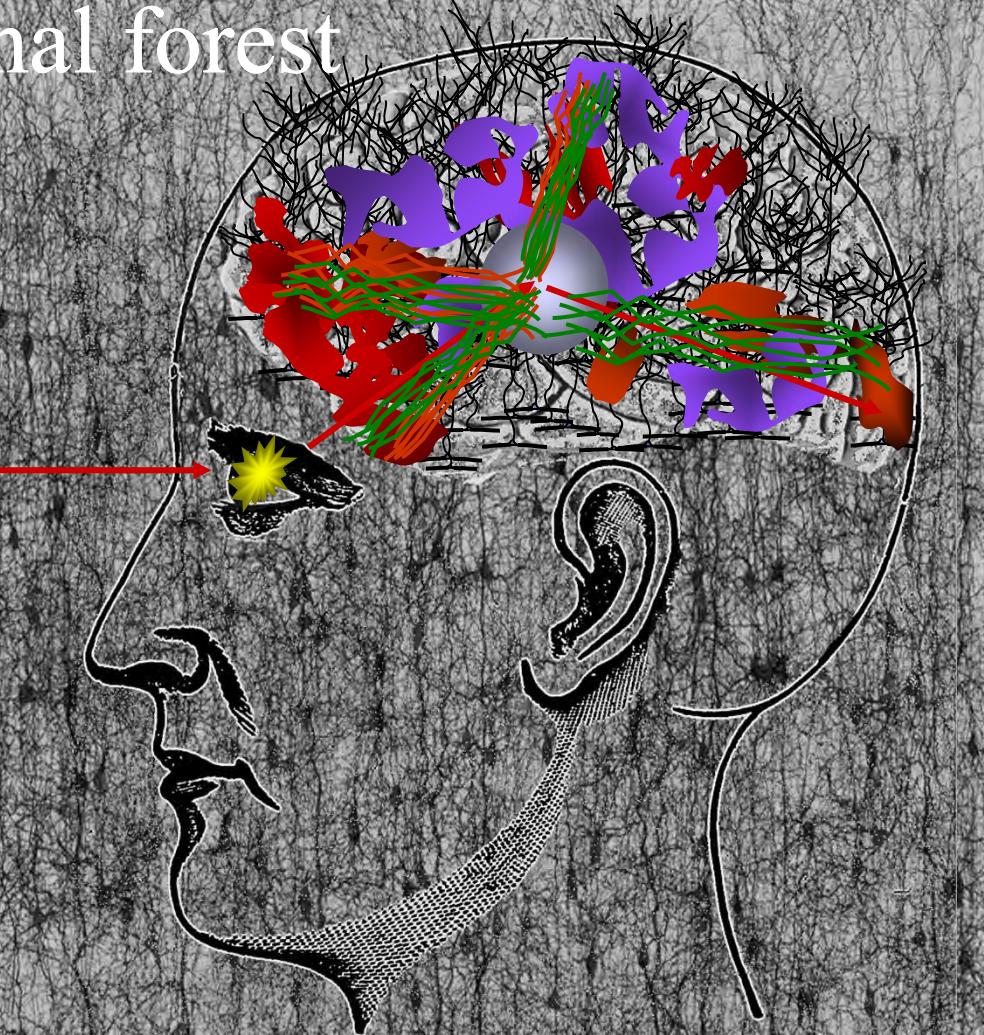


Telescopio espacial Hubble



Nebulosas cerebrales

Neuronal forest



How neuronal circuits contribute to the functional organization of the brain, giving rise to cognition and behavior?



Muchas gracias