



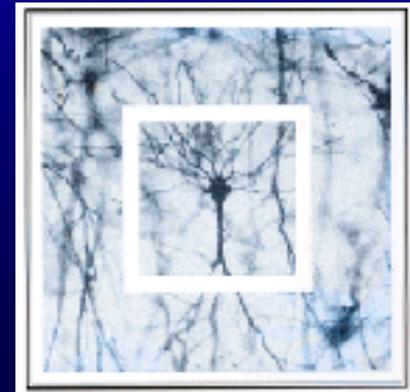
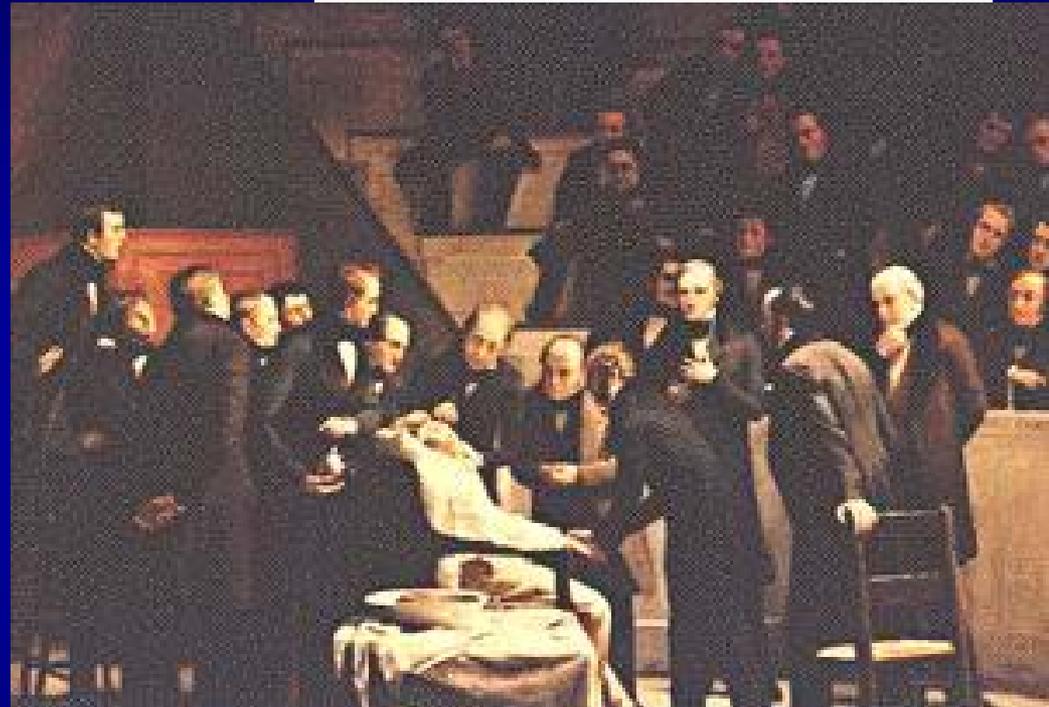
REAL ACADÈMIA DE MEDICINA  
Y CIÈNCIES AFINES  
DE LA COMUNITAT VALENCIANA



REAL ACADEMIA DE MEDICINA Y CIRUGIA DE MURCIA



Reunión Conjunta 26 Noviembre 2010  
Elche



**Avances en Neuroimagen,**  
de la magia a la realidad aumentada.

Cecilio Poyatos Ruipérez  
Unidad de Resonancia Magnética  
Hospital Universitario Dr. Peset Valencia (España)

**Los avances científicos que se han producido durante los últimos ciento cincuenta años sobre la estructura y el funcionamiento del sistema nervioso han puesto de manifiesto no sólo el papel rector que el cerebro ejerce respecto del resto del organismo.**

**Sino la posibilidad de actuar sobre él.**

**“Todas las funciones orgánicas están reguladas de alguna manera por el cerebro y existe un permanente flujo de información entre los órganos y el cerebro”.**





Donde radica la  
función mental .....el  
alma

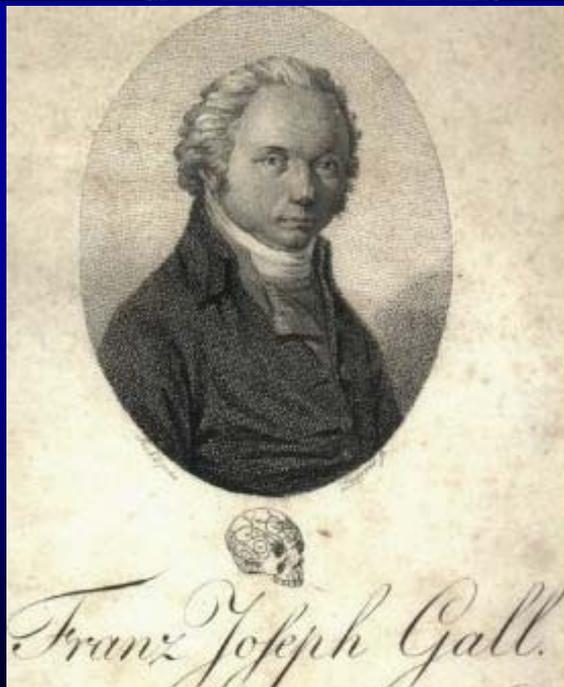
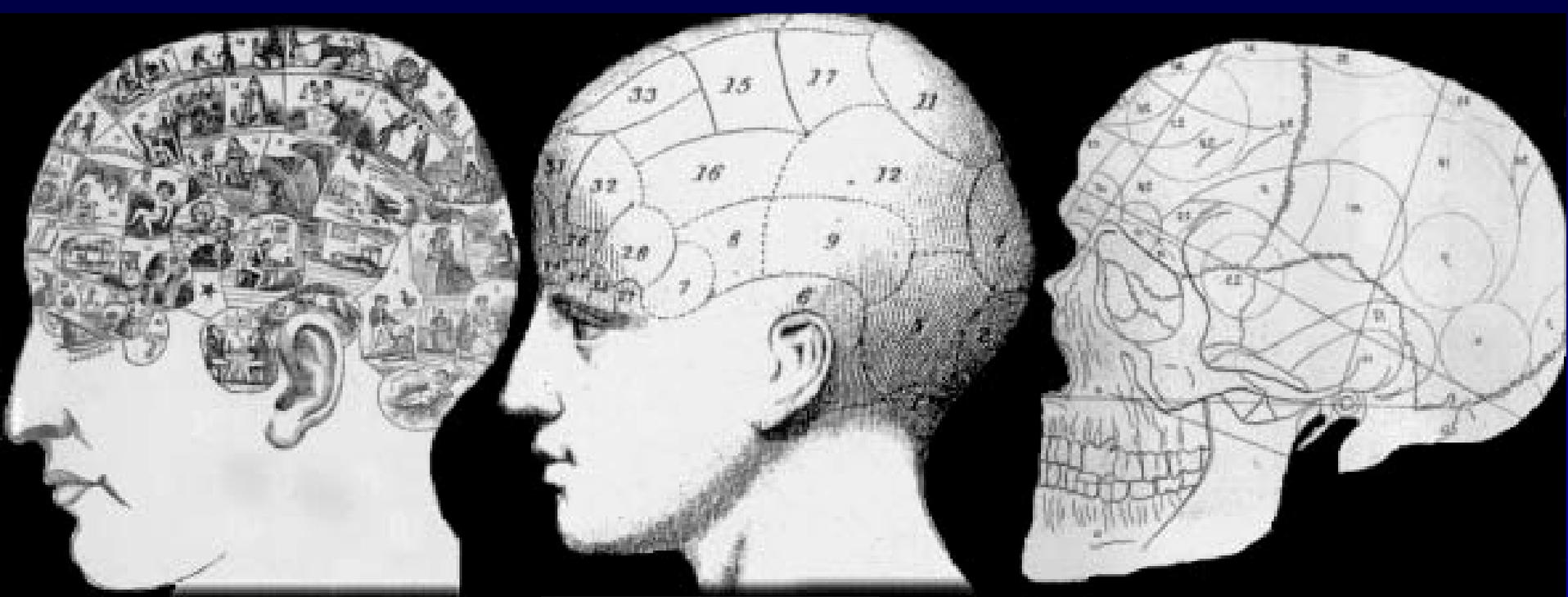
Empíricamente entre otros Platón  
la situó en el interior de la cabeza  
... “cerebro”.

Fue un planteamiento inicial  
→ fue aceptado por Galeno

→ Alberto Magno 1193-1280

Ventrículos

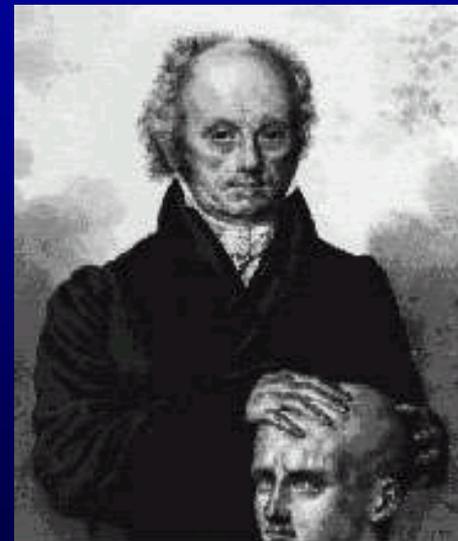
Líquido cefalorraquídeo

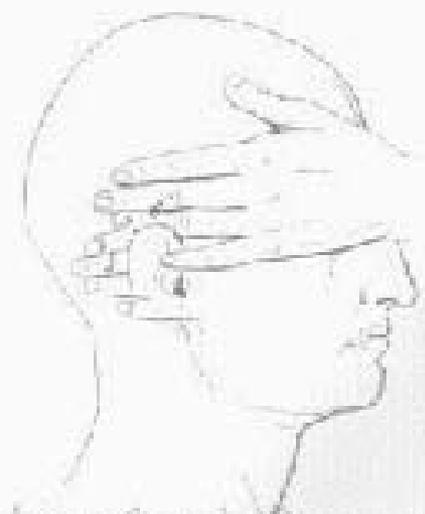


Franz Joseph Gall (1758-1828)  
Viena → Frenología

1. El cerebro es el órgano de la mente.
2. La mente se compone de múltiples y distintas facultades innatas.
3. Al ser distintas las facultades deben tener un asiento distinto u *órgani* en el cerebro.
4. El tamaño de un órgano es medida de su poder, teniendo en cuenta que lo demás sea igual.
5. La forma o morfología del cerebro viene determinada por el desarrollo de los distintos órganos.
6. Como el cráneo toma su forma del cerebro, la superficie del cráneo se puede leer como un índice preciso de las tendencias y aptitudes psicológicas.

Franz Joseph Gall (1758-1828)  
Frenología





The history of phrenology on the web

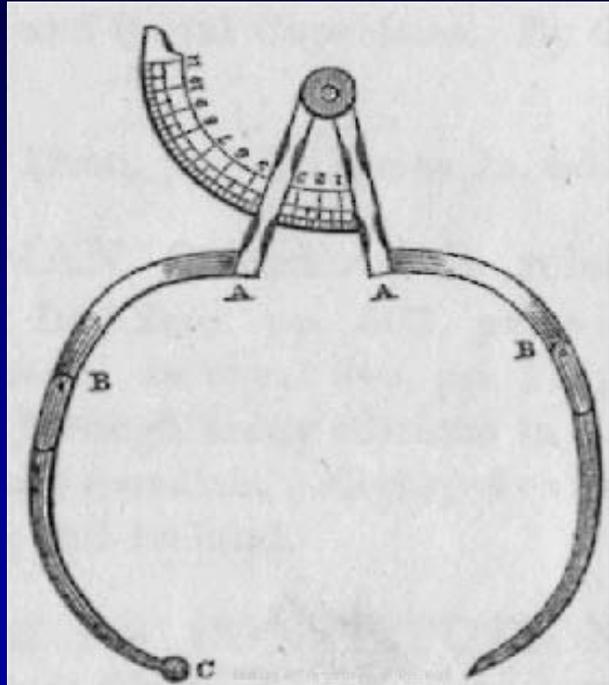
The history of phrenology on the web



Perímetro cefálico



Cinta métrica



Cefalógrafo

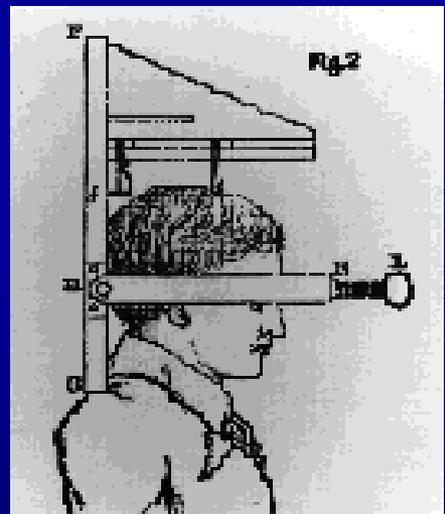
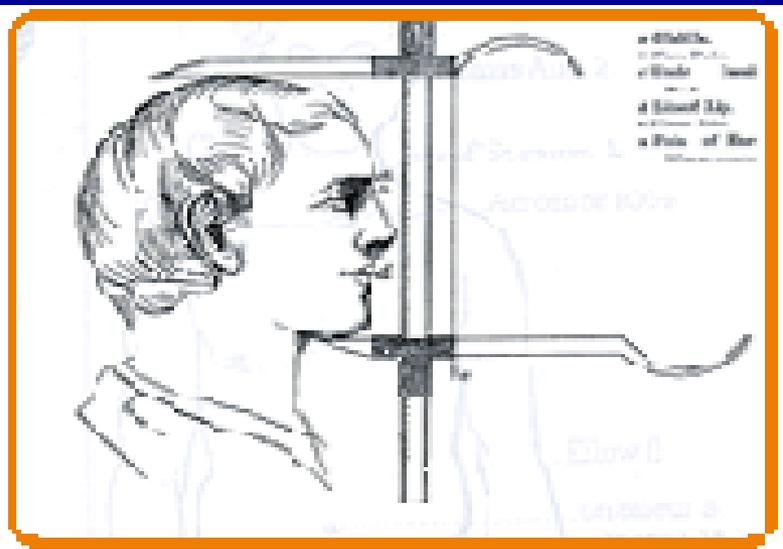


Figure 17  
A cephalograph designed by Herbert Spencer to achieve more reliable phrenological measurement of the cranium, from his Autobiography (1904).

**AMERICAN PHRENOLOGICAL JOURNAL**  
 KNOW THYSELF.

HOME TAUGHTS FOR HOME CONSUMPTION.

1848.

VOL. X. MARCH. NO. 3.

O. S. FOWLER, EDITOR.

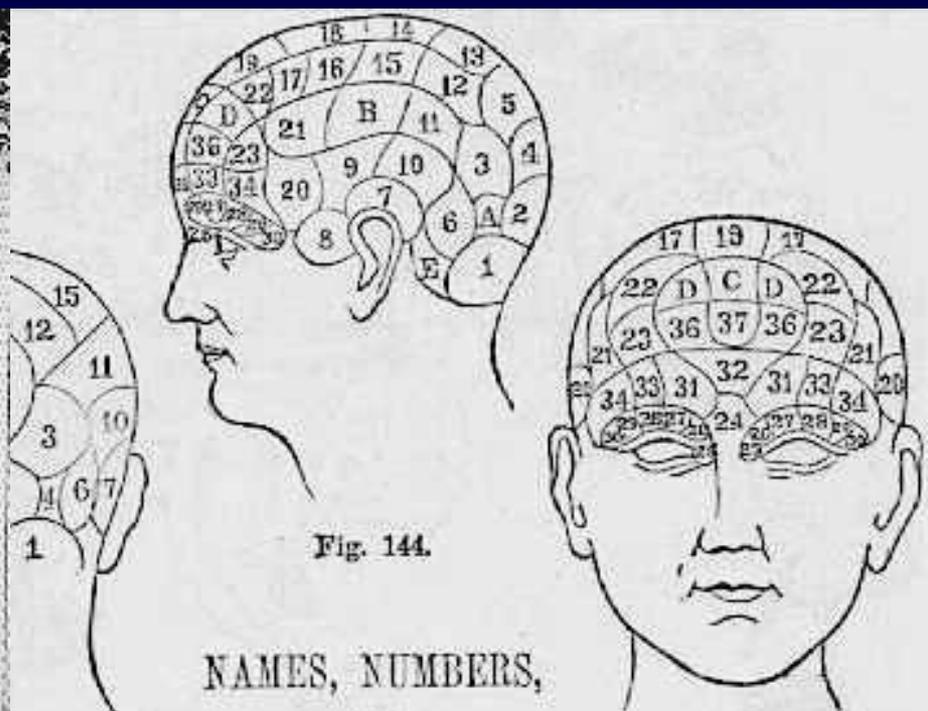


Fig. 144.

NAMES, NUMBERS,  
 AND  
 LOCATION OF THE ORGANS.

VE.	18. SELF-ESTEEM.	26. SIZE.
VE.	14. FIRMNESS.	27. WEIGHT.
SS.	15. CONSCIENTIOUSNESS.	28. COLOR.
SS.	16. HOPE.	29. ORDER.
SS.	17. SPIRITUALITY.	30. CALCULATION.
NESS.	18. VENERATION.	31. LOCALITY.
ESS.	19. BENEVOLENCE.	32. EVENTUALITY.
S.	20. CONSTRUCTIVENESS.	33. TIME.
NESS.	21. IDEALITY.	34. TUNE.
ESS.	B. SUBLIMITY.	35. LANGUAGE.
ESS.	22. IMITATION.	36. CAUSALITY.
S.	23. MIRTH.	37. COMPARISON.
S.	24. INDIVIDUALITY.	C. HUMAN NATURE.
NESS.	25. FORM.	D. SUAVITY.

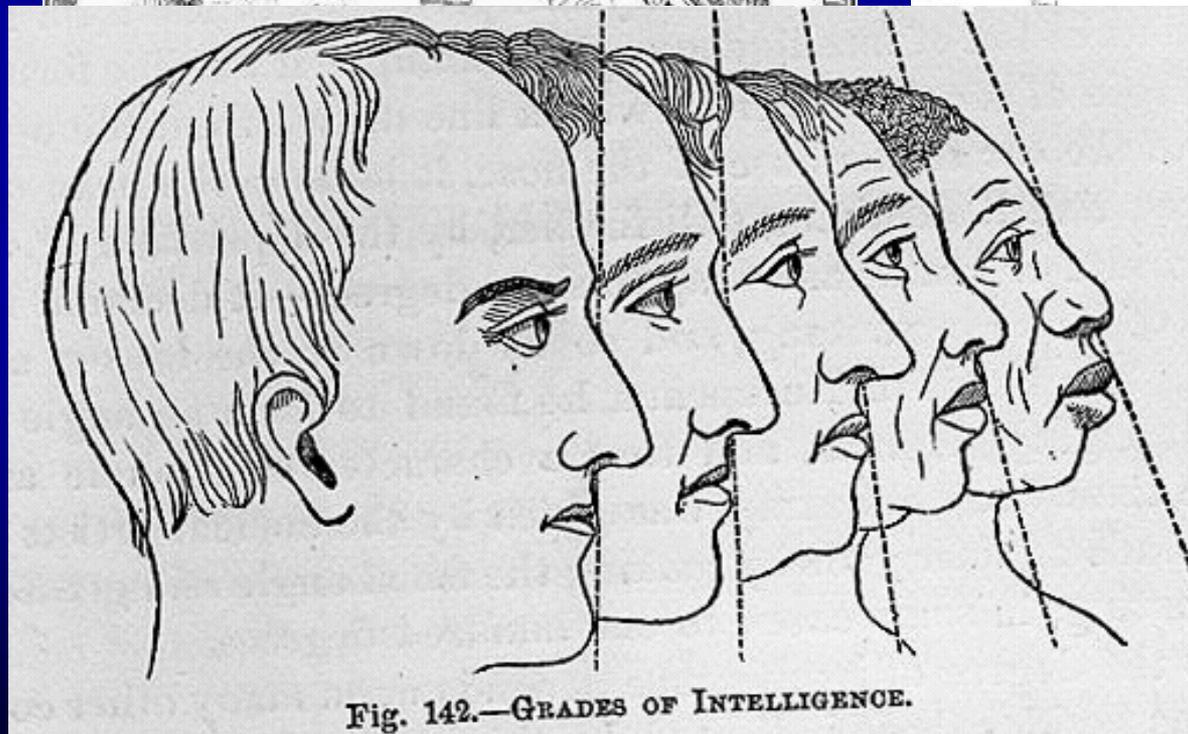
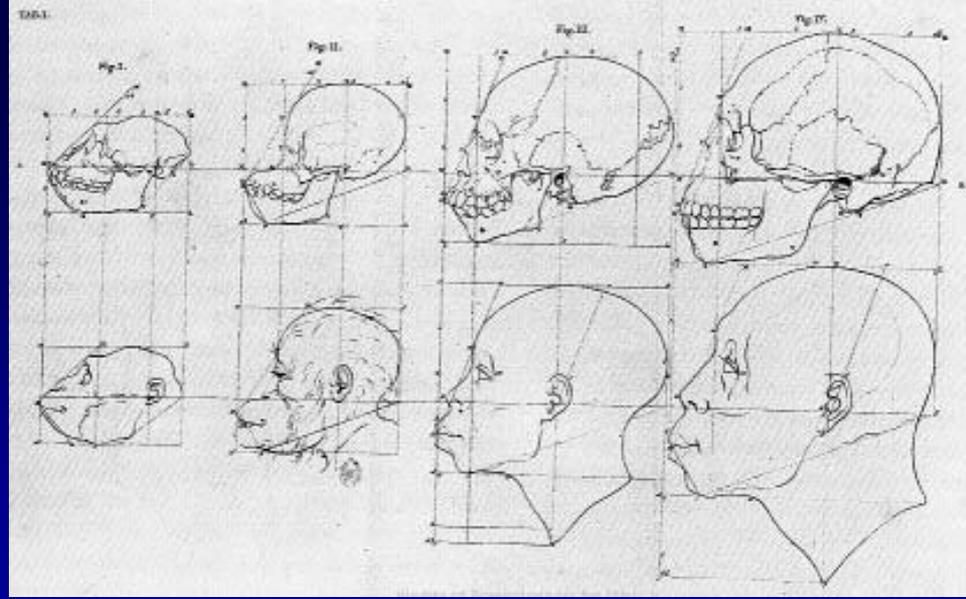
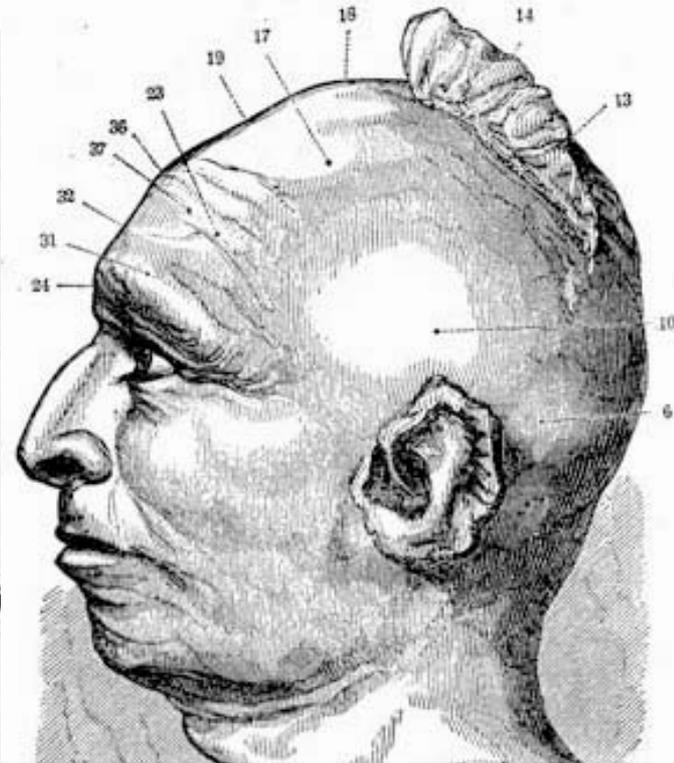
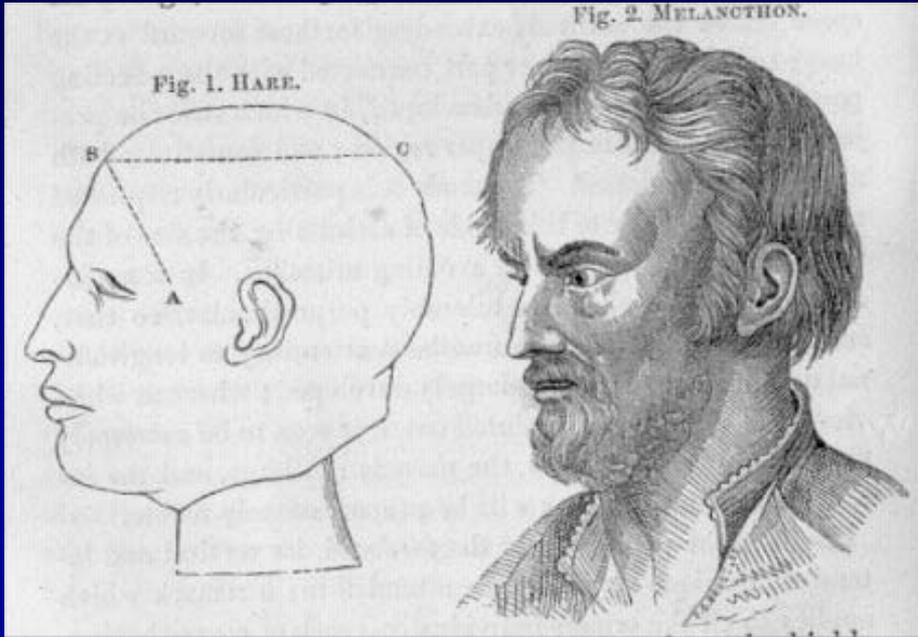


Fig. 142.—GRADES OF INTELLIGENCE.





Goethe →

Por delante de la línea AB lóbulo anterior → facultades intelectuales  
Por encima de BC → sentimientos morales

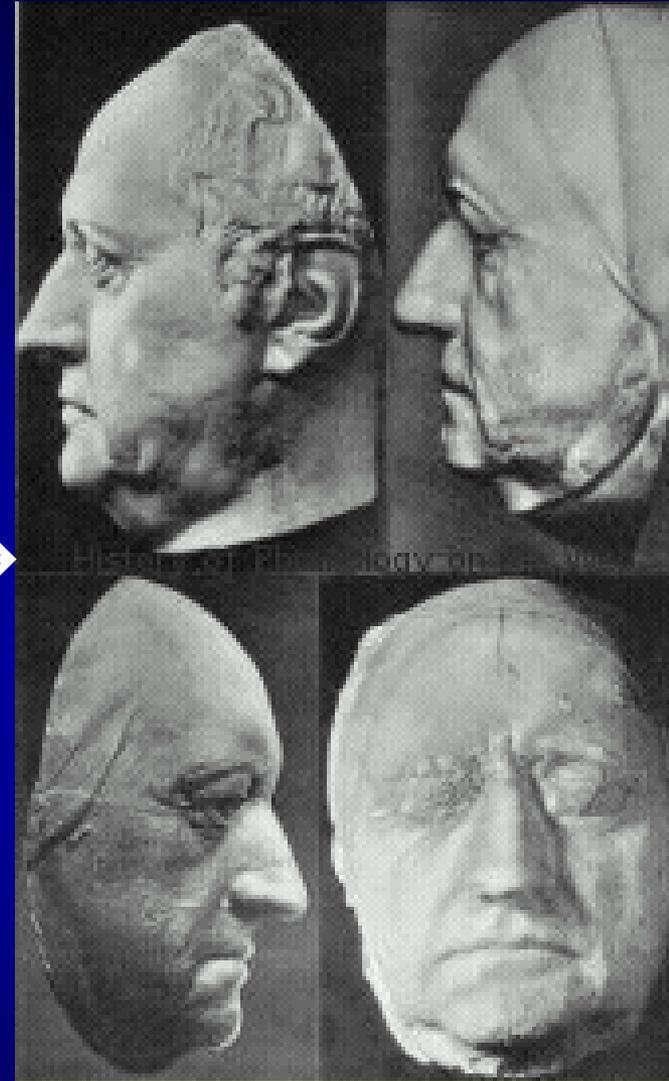




Fig. 905.—Ass.



Fig. 906.—A DONKEY.



Fig. 903.—Hog.



Fig. 904.—HOGGISH.

## Cesare Lombroso 1835-1909 Antropología criminal → Fisionomía



Fig. 901.—BEAR.



Fig. 902.—A GREAT BEAR.



Fig. 899.—LION.

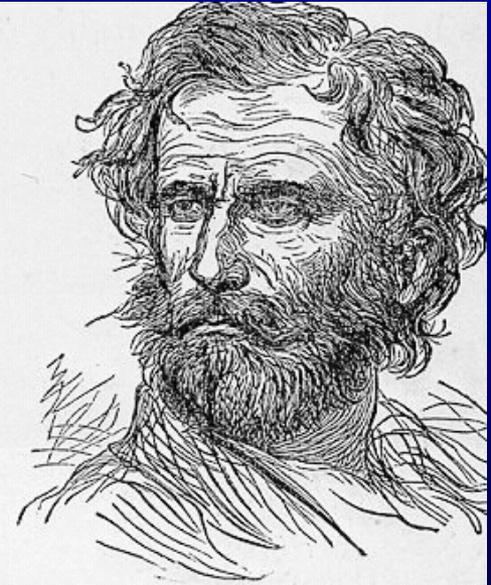


Fig. 900.—LEONINE.

# Fundamentos de imputabilidad penal

## Cognitivos

## Volitivos

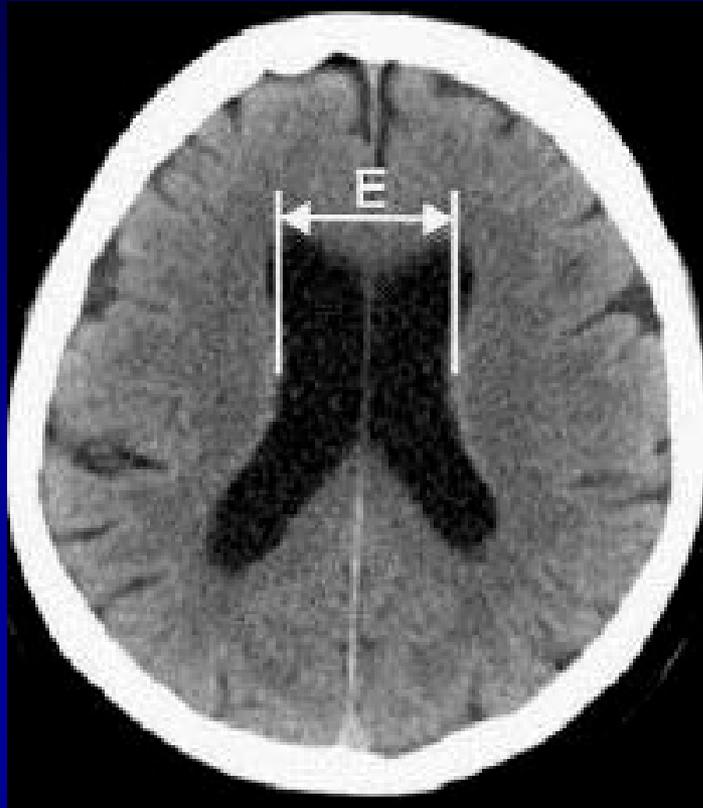
La evaluación del cortex cerebral para detectar la existencia de lesiones que potencialmente pueden alterar la comisión de actos criminales y la capacidad de comprender la naturaleza de sus acciones que deberían influir en el curso del proceso legal.

Correlación entre los daños cerebrales y el carácter y la intensidad de los signos y síntomas psicopatológicos.

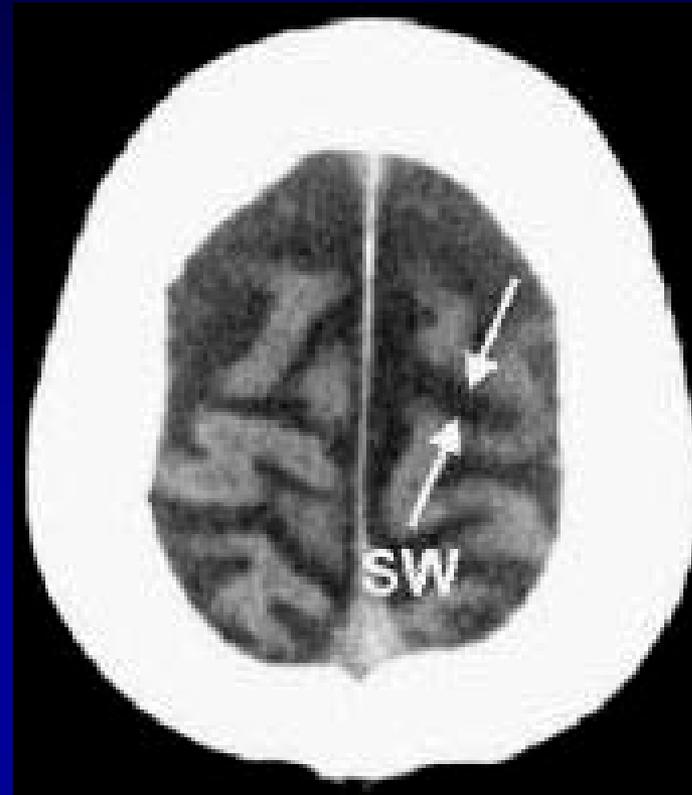
- Atrofia cortical y subcortical que excede los valores de la normalidad en especial en sujetos menores de 20 años en lóbulos frontales, con menor afectación de lóbulos temporales y estructuras límbicas  
Así como el índice ventricular elevado

“Nacido criminal”

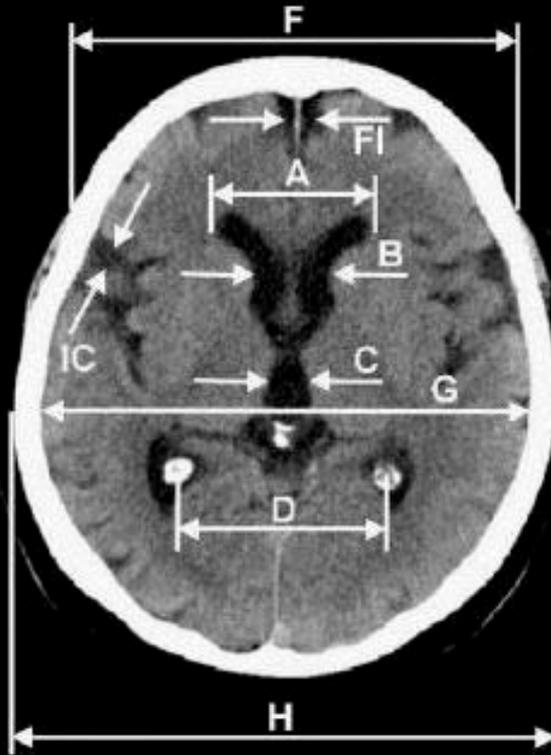
Los tatuajes son una característica de los “hombres primitivos”



Distancia más larga entre los cuerpos de los ventrículos laterales



Distancia más larga entre las circunvoluciones cerebrales en la superficie de la convexidad cerebral, o anchura de los surcos cerebrales

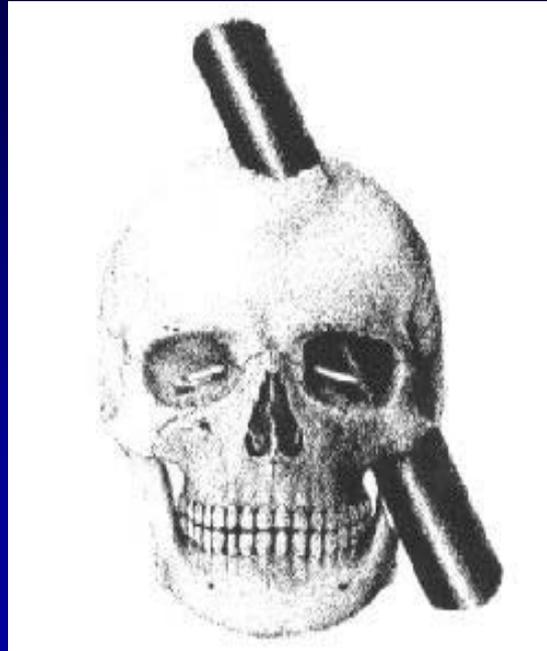


Degree of atrophy	Age	Width of ventricular system					Width of subarachnoid space
		C	F/A	D/A	H/E	A+B	
Within normal range	0-20	<3.90	>3.70	>1.69	>4.50	<40.00	<3.00
	21-40	<4.56	>3.55	>1.57	>4.27	<47.51	<4.16
	41-60	<6.96	>3.35	>1.47	>3.97	<55.51	<5.36
	>60	<8.96	>3.15	>1.37	>3.67	<63.51	<6.56
Low-grade atrophy	0-20	3.90-4.55	3.70-3.56	1.69-1.58	4.50-4.28	40.00-47.50	3.00-4.15
	21-40	4.56-6.95	3.55-3.36	1.57-1.48	4.27-3.98	47.51-55.50	4.16-5.35
	41-60	6.96-8.95	3.35-3.16	1.47-1.38	3.97-3.68	55.51-63.50	5.36-6.55
	>60	8.96-11.55	3.15-2.96	1.37-1.28	3.67-3.38	63.51-71.50	6.56-7.75
Moderate atrophy	0-20	4.56-6.95	3.55-3.36	1.57-1.48	4.27-3.98	47.51-55.50	4.16-5.35
	21-40	6.96-8.95	3.35-3.16	1.47-1.38	3.97-3.68	55.51-63.50	5.36-6.55
	41-60	8.96-11.55	3.15-2.96	1.37-1.28	3.67-3.38	63.51-71.50	6.56-7.75
	>60	11.56-14.95	2.95-2.76	1.27-1.18	3.37-3.08	71.51-79.50	7.76-8.95
High-grade atrophy	0-20	6.96-8.95	3.35-3.16	1.47-1.38	3.97-3.68	55.51-63.50	5.36-6.55
	21-40	8.96-11.55	3.15-2.96	1.37-1.28	3.67-3.38	63.51-71.50	6.56-7.75
	41-60	11.56-14.95	2.95-2.76	1.27-1.18	3.37-3.08	71.51-79.50	7.76-8.95
	>60	>=14.96	<=2.75	<=1.17	<=3.07	>=79.51	>=8.96

Atrofia cerebral en especial de lóbulos frontales se asocia con individuos de menos de 40 años con conducta agresiva y actos criminales violentos

## Conclusion

Cerebral atrophy exceeding physiological values, particularly subcortical atrophy of the frontal lobes, which indicates characteropathy as a potential cause of aggressive behavior characterized by violent criminal acts (manslaughter), is significant in subjects below 40 years of age. On the other hand, in individuals older than 40 years of life who manifest such violent behavior, the observed degree of cerebral atrophy does not differ significantly from values regarded as standards.



Phineas P. Gage en 1848, con 25 años  
Cambio de personalidad tras un accidente una barra metálica de 1 metro por 3 cm le atravesó el cráneo por delante, sobreviviendo a la lesión

→ brusco, insolente, lenguaje chabacano,.....

Su caso indicaba que los lóbulos frontales eran responsables de las emociones y otras características de la personalidad



Paul Broca  
1824-1880



## Afemia → Afasia

Lesión en lóbulo frontal izquierdo  
(área motora del habla)

1861 → autopsia de “Tan”  
“neurosífilis”  
trastorno en el lenguaje

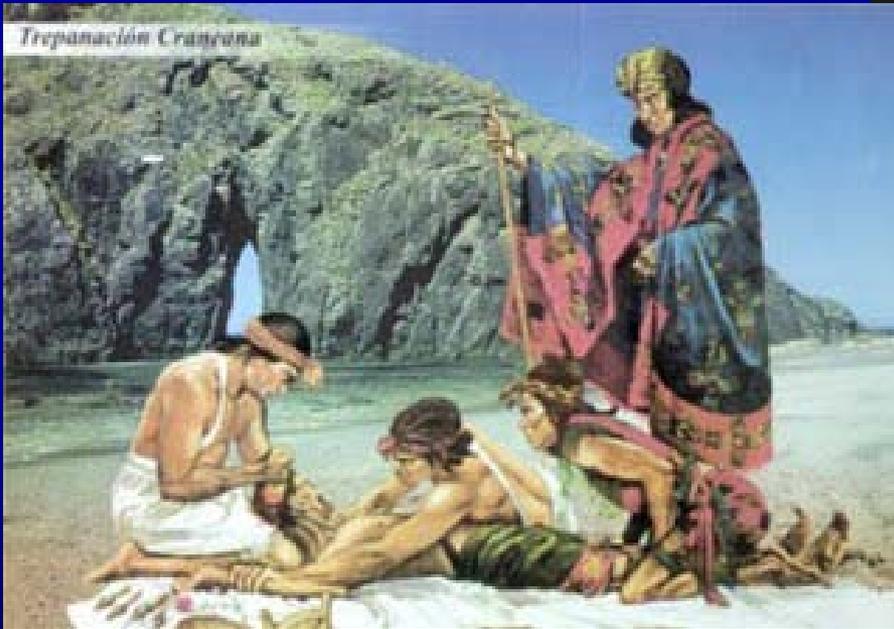
Habla balbucente o telegráfica



**Encefalopatía asociada a la afasia de Wernicke  
(pérdida de la comprensión y la sintaxis)**

“Ver para creer”

Trepanación se practica ya desde el neolítico. Aquí en momia de niño romano de 5-6 años (The Lancet) →



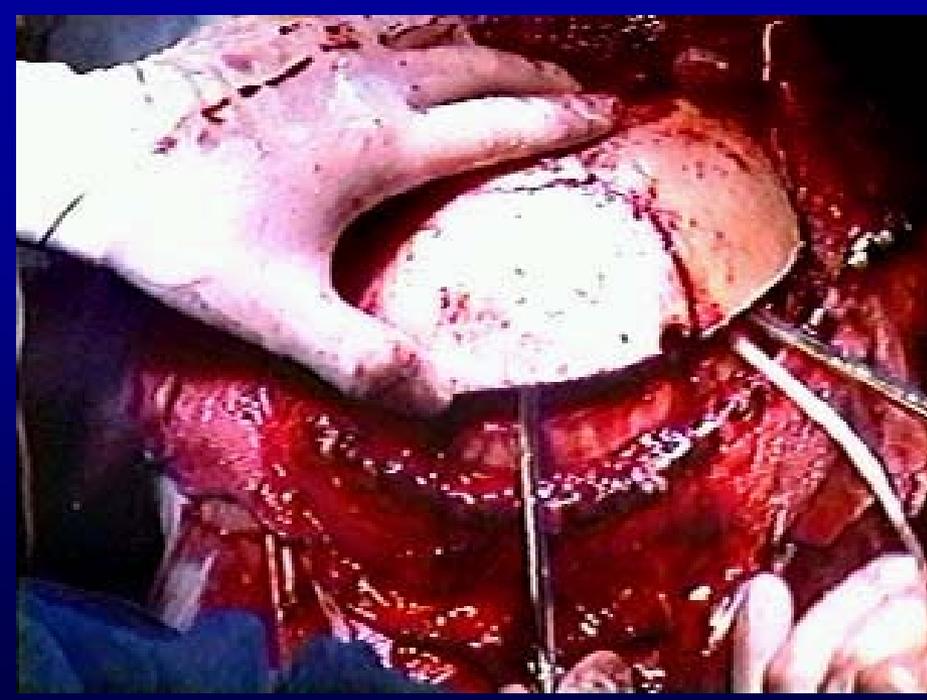
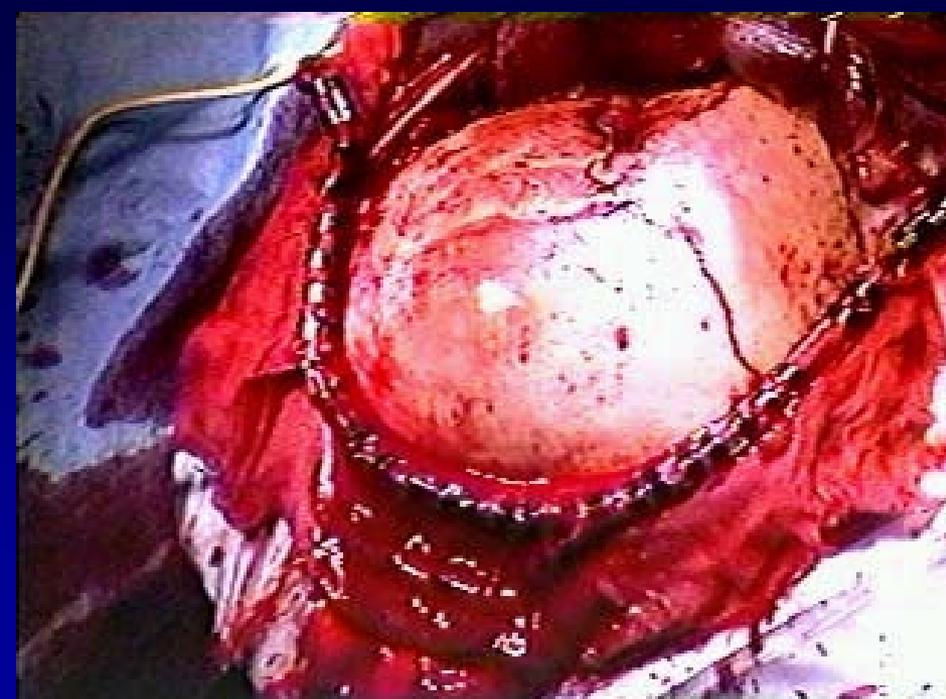
Cultura paracas en el Perú



Siglo XVIII

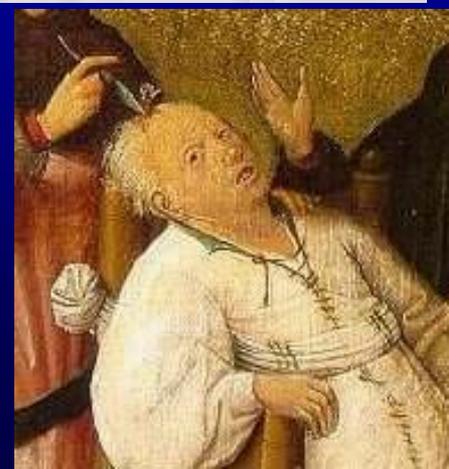


Siglo XX

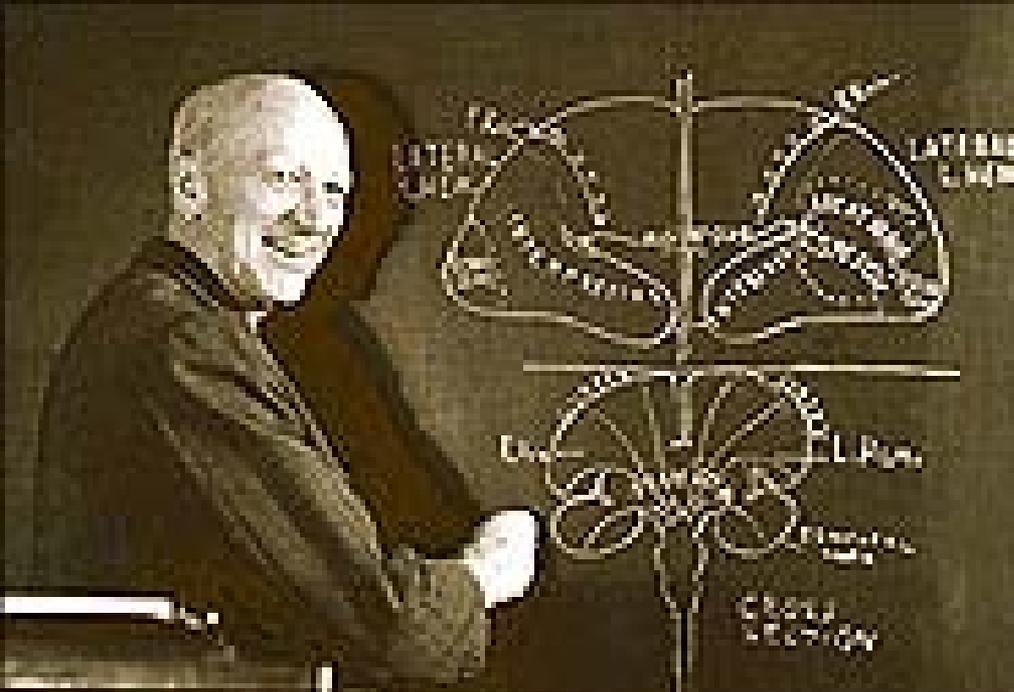




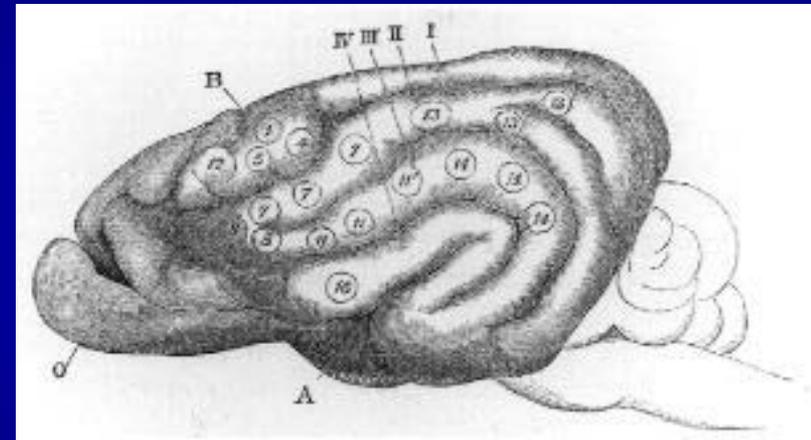
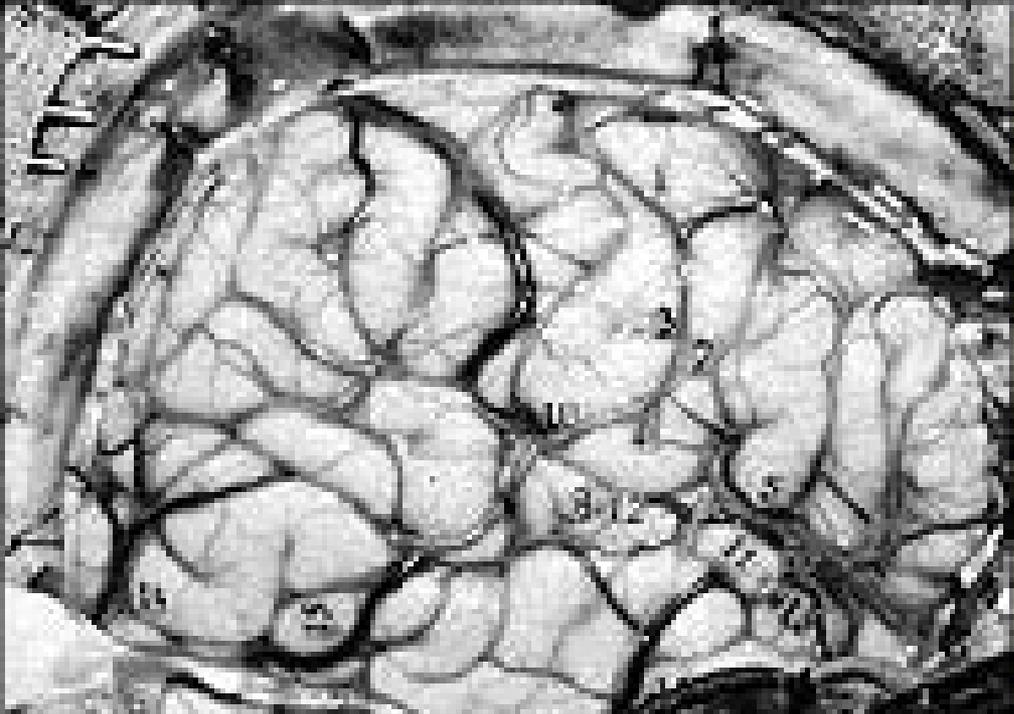
Extracción de la  
piedra de la locura  
“*Pierre de folie*”  
Jerónimo Bosco  
(Hieronymus Bosch)  
Museo de Prado







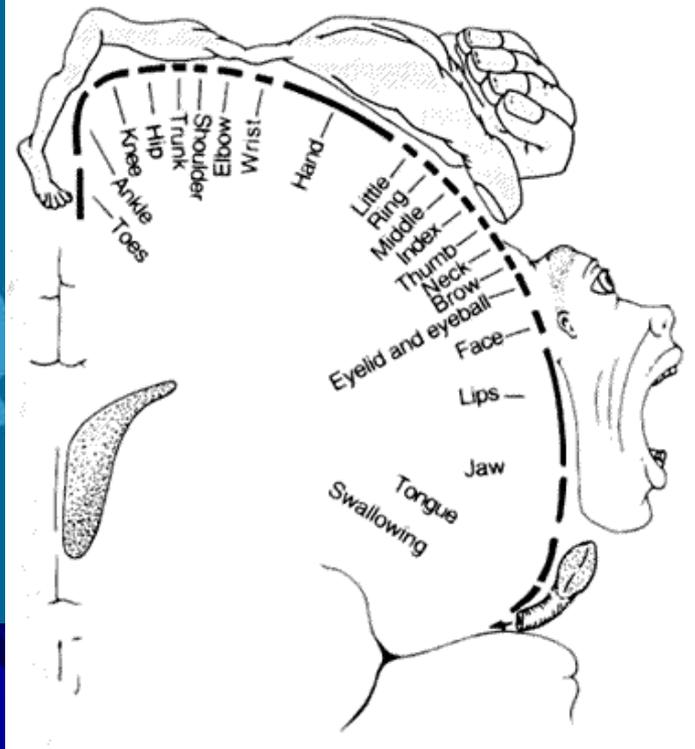
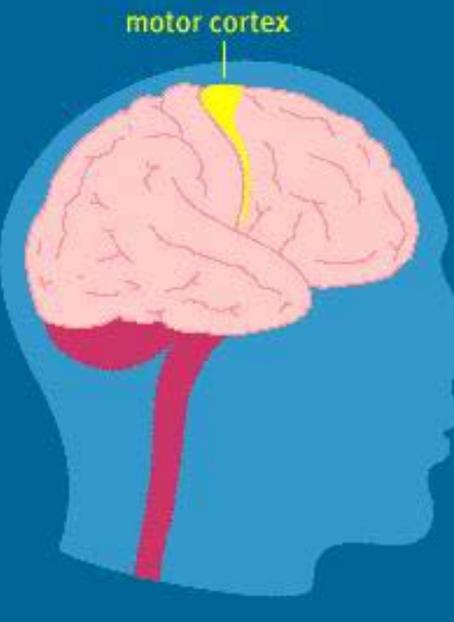
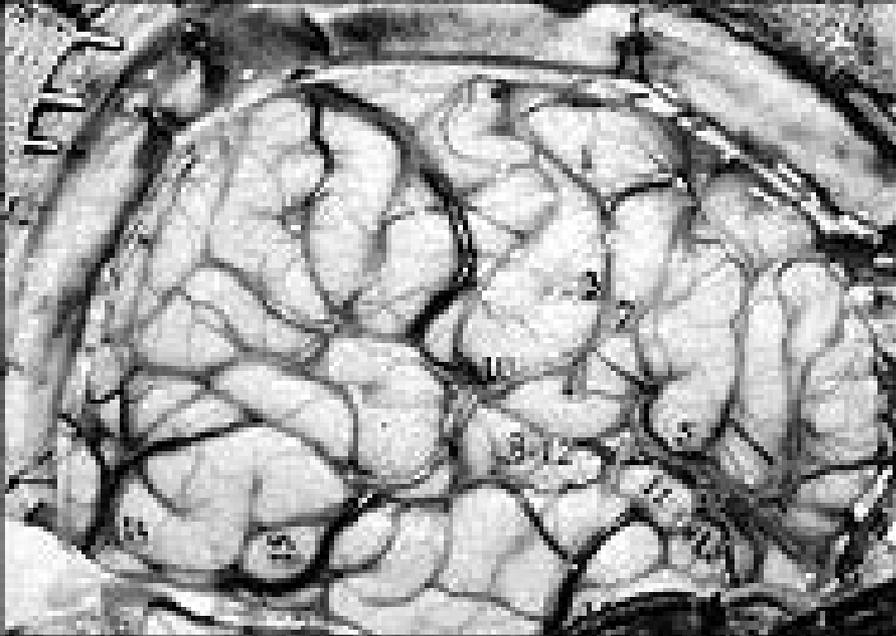
Gall → P. Flourens 1825 → P.P. Broca 1861 → Wernicke → Hitzig y Fritsch 1870 → F. Krause → D. Ferrier 1870-75 →



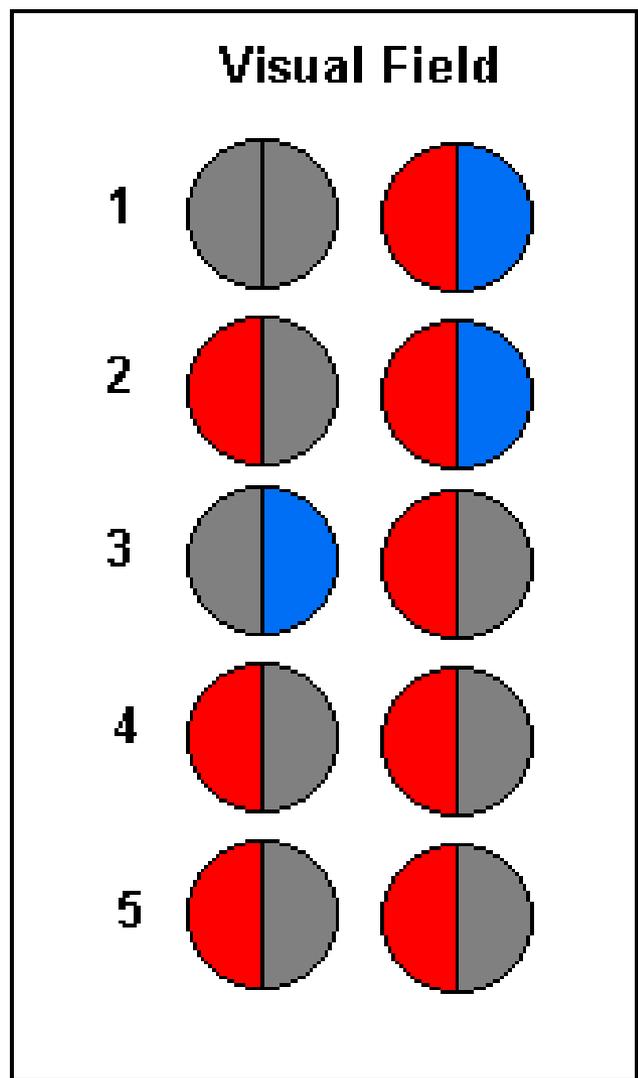
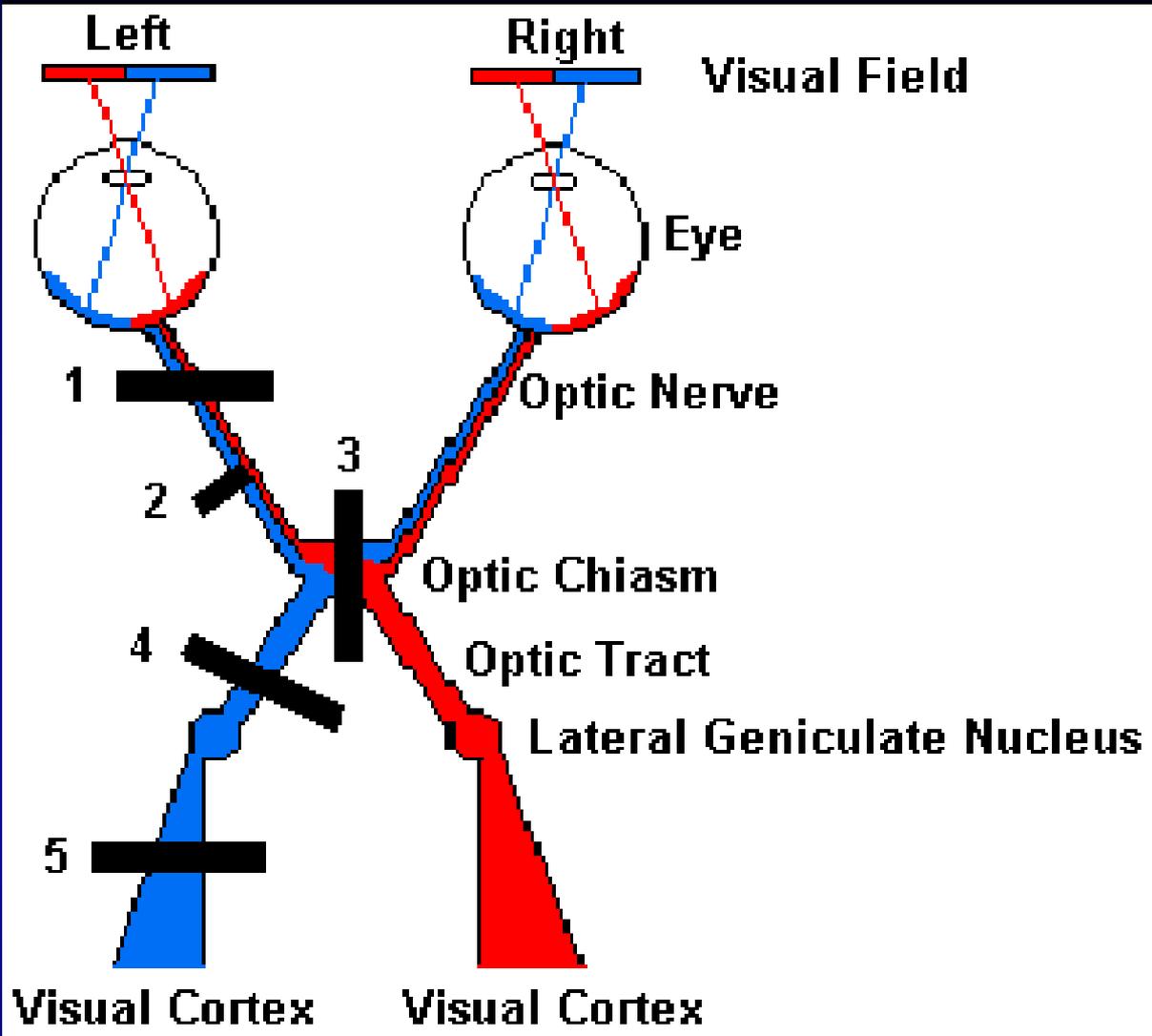
Cortex de mono de Ferrier

Wilder Graves Penfield  
1940

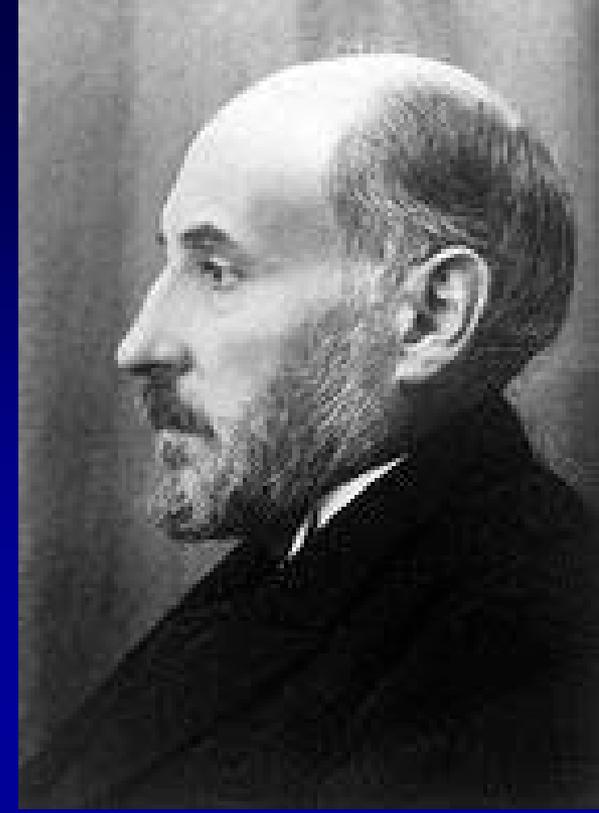
Wilder Graves Penfield  
1891-1976 (1940)



Homúnculo



Decusación que no es tan definida en sujetos albinos



**1852-1934**

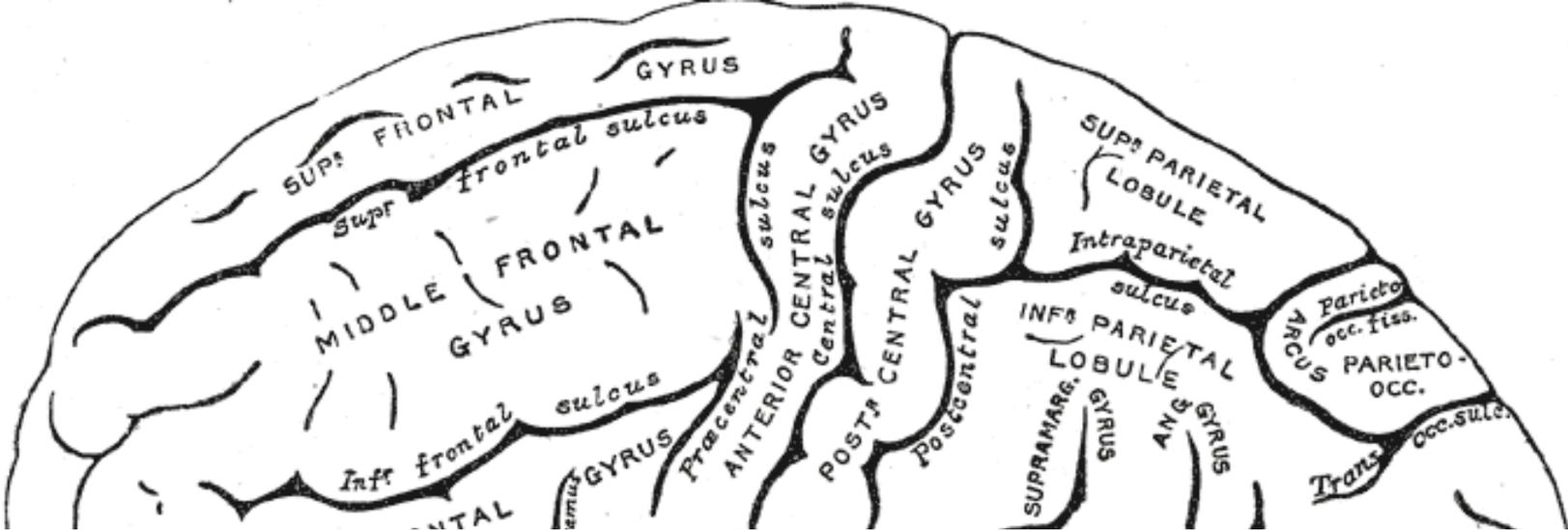
**Premio Nobel 1906**

**Teoría neuronal**

**Opuesta a la “teoría reticular” de Camilo Golgi**

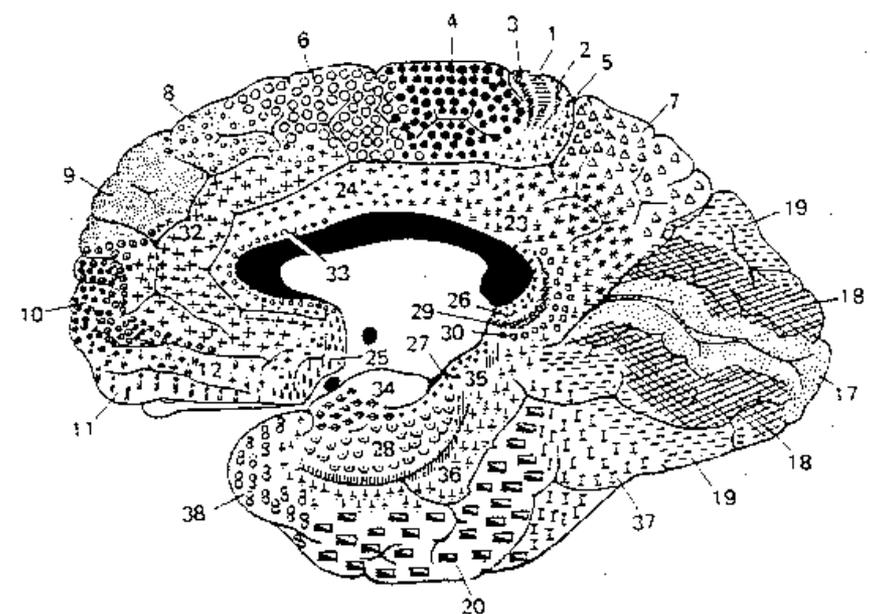
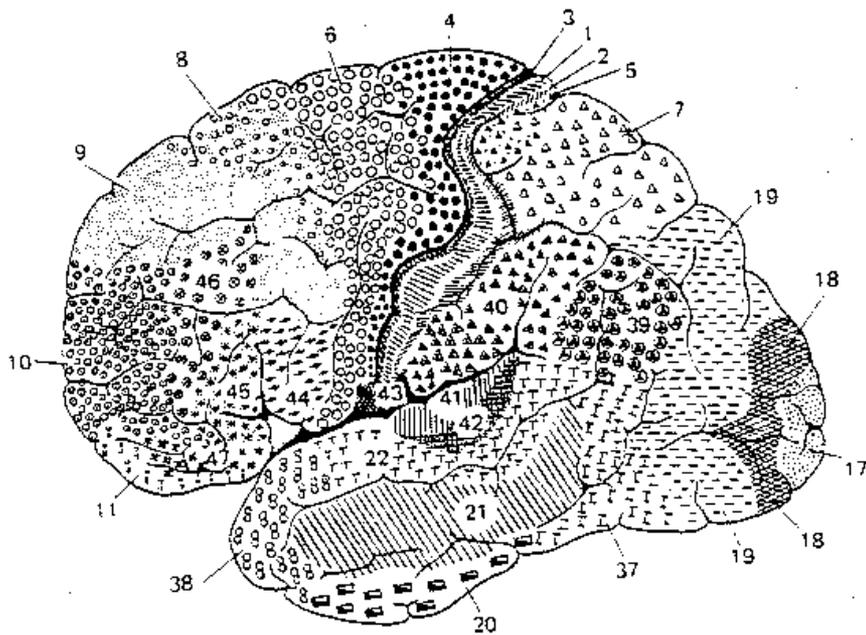


**1920**

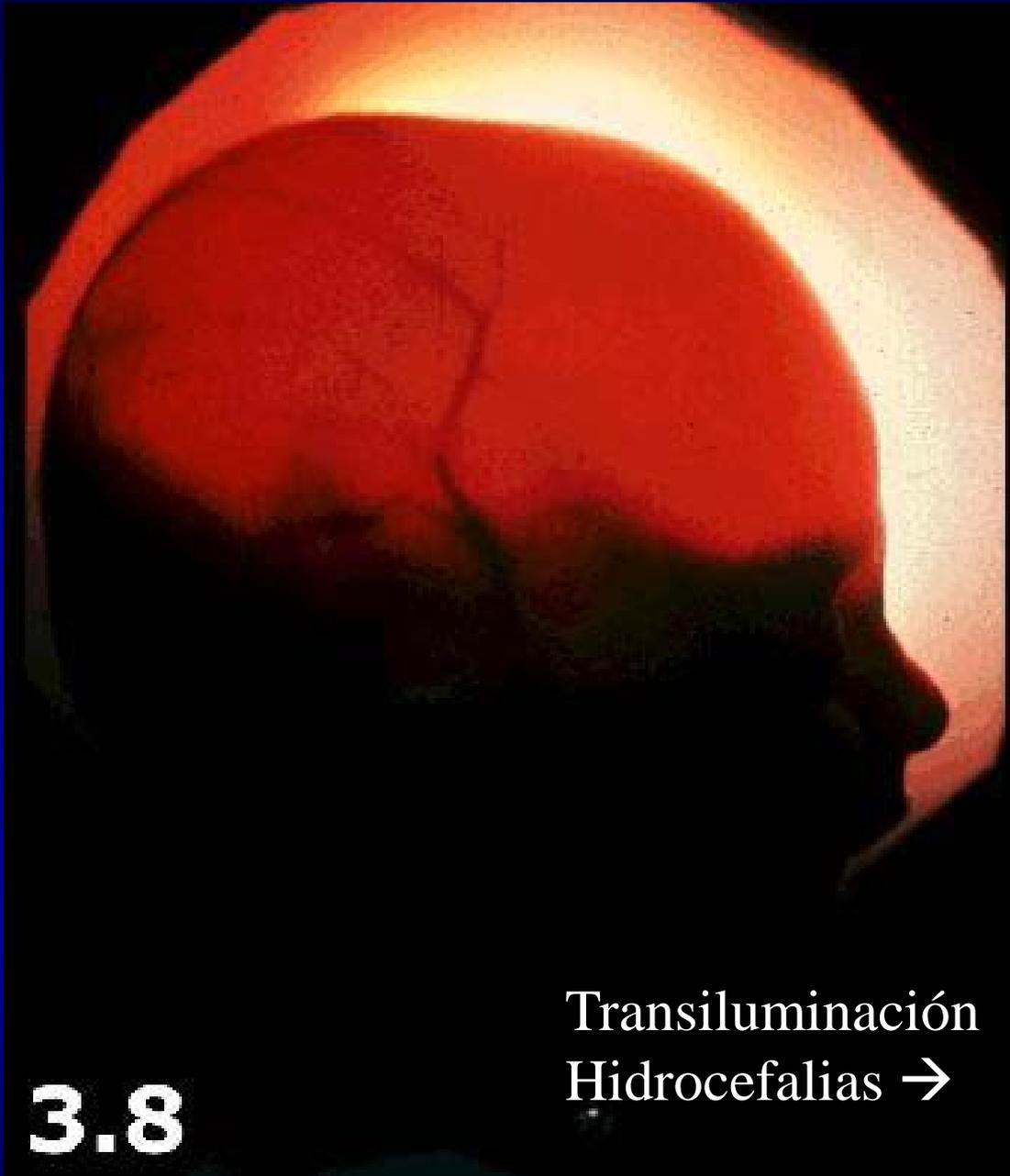


Lateral view

Medial view



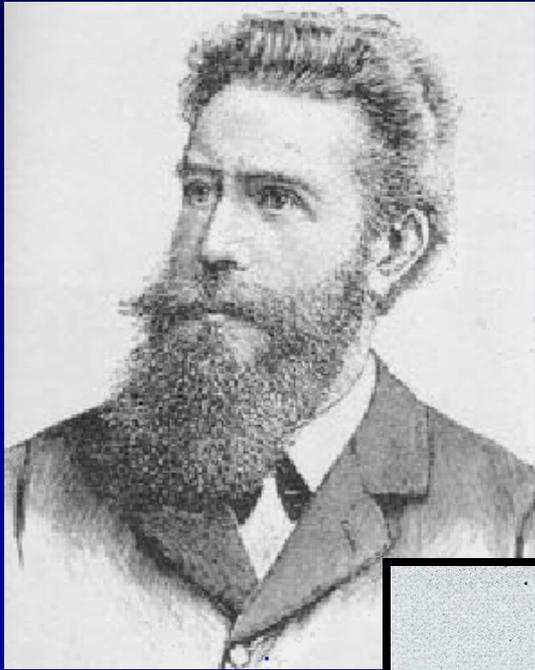
Citoarquitectura → Korbinian BRODMANN (tamaño y densidad celular 50 áreas) 1909



**3.8**

Transiluminación  
Hidrocefalias → hidranencefalia

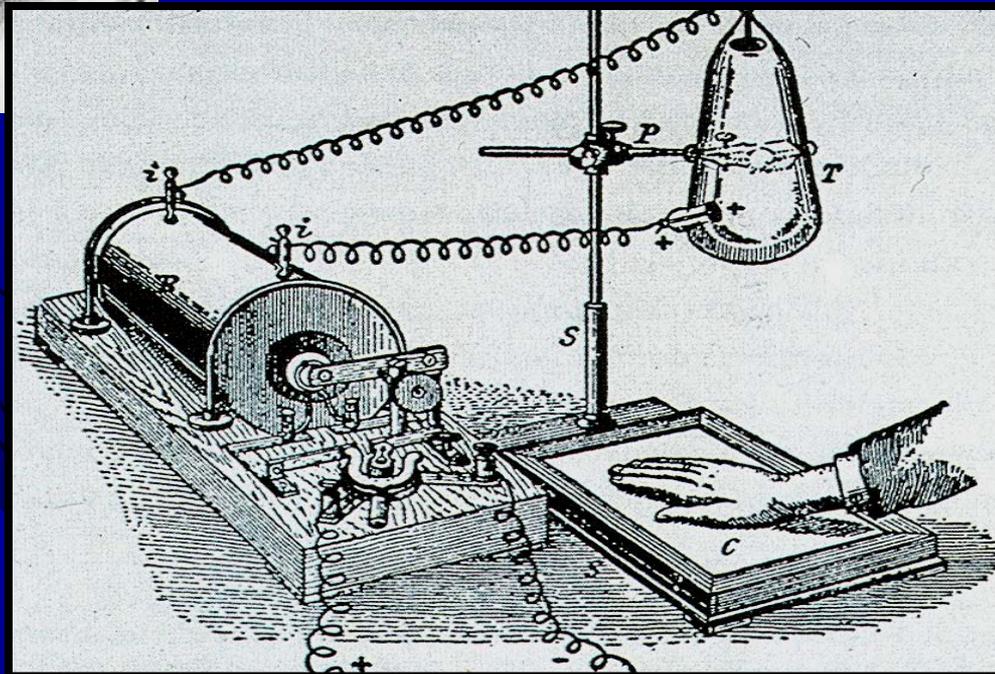
# Wilhelm Konrad Röntgen (Roentgen) (1845-1923)



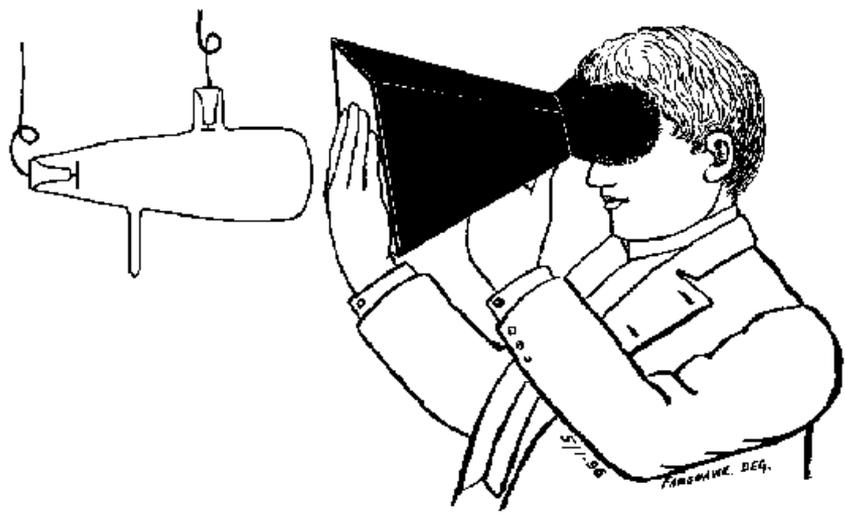
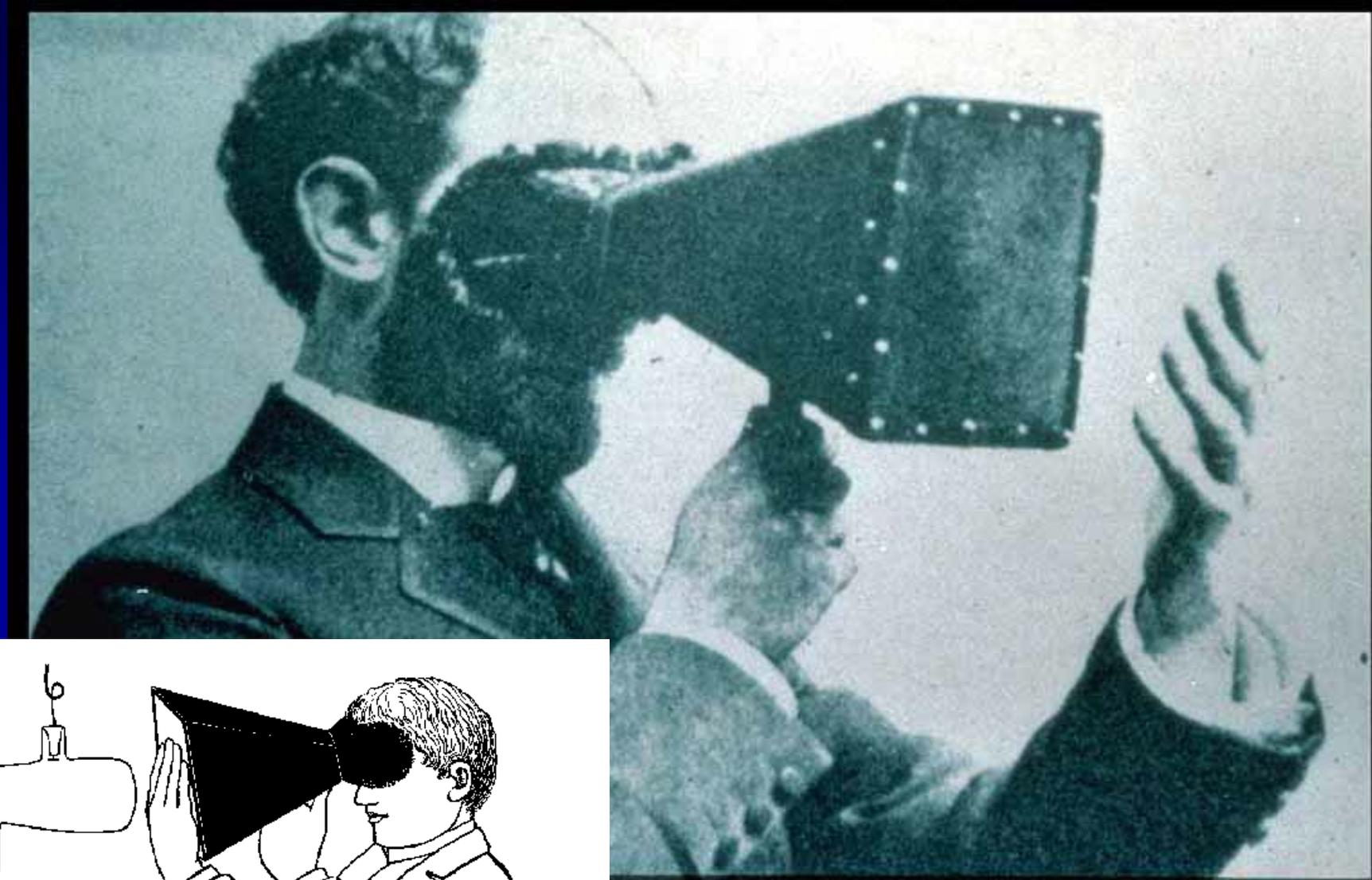
**1895** Tubo de rayos catódicos

Sobre una nueva especie de rayo  
Universidad de Würzburg → 1896

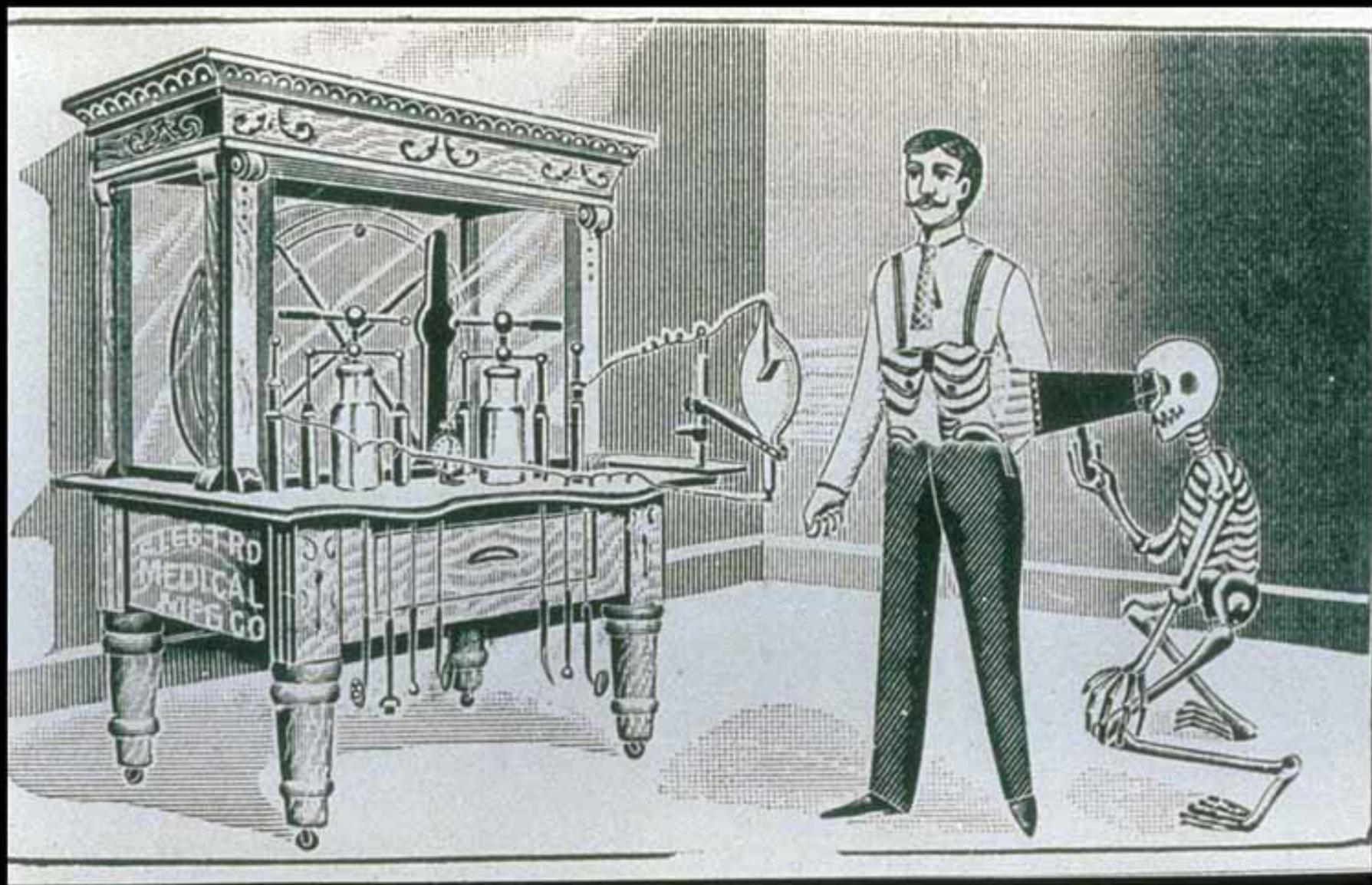
**Premio Nobel Física 1901**

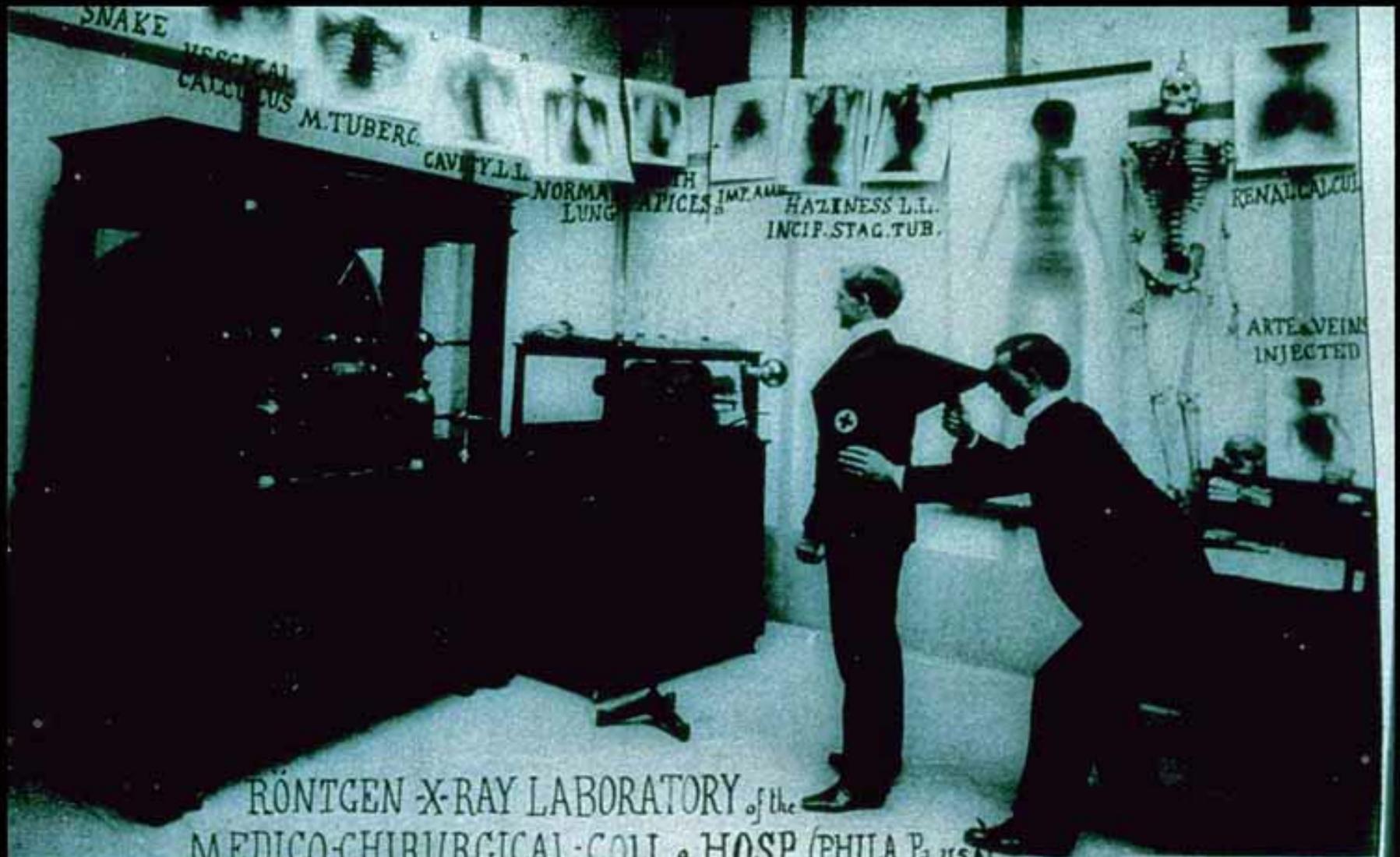


Tubos de  
Crookes



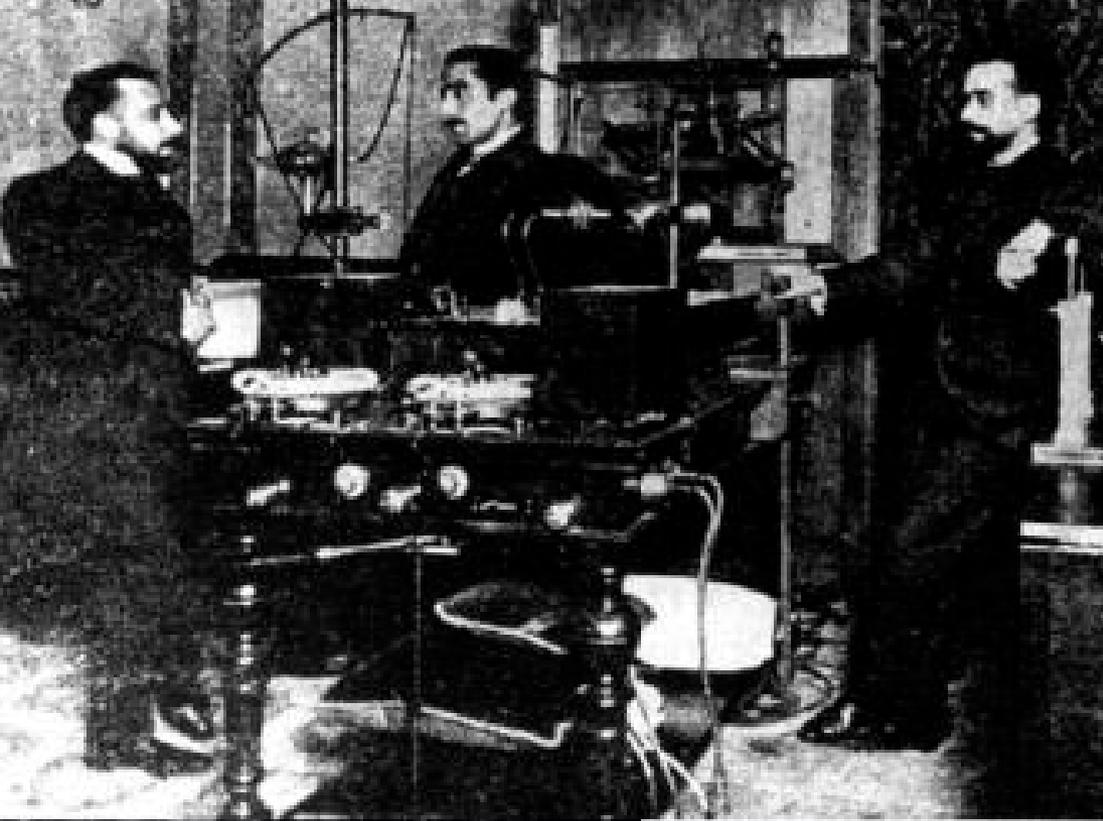
**Pantalla fluorescente**





RÖNTGEN X-RAY LABORATORY of the  
MEDICO-CHIRURGICAL COLL. & HOSP. (PHILA. Pa. U.S.A.)

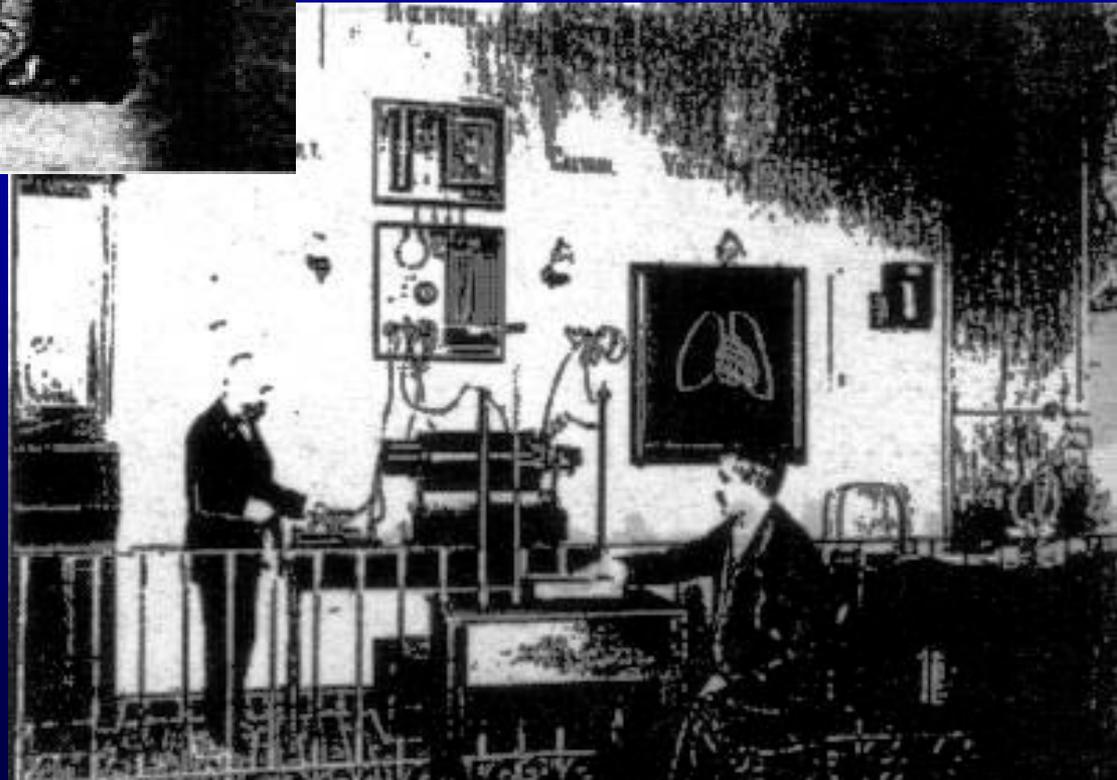
DR. M. K. KASSABIAN

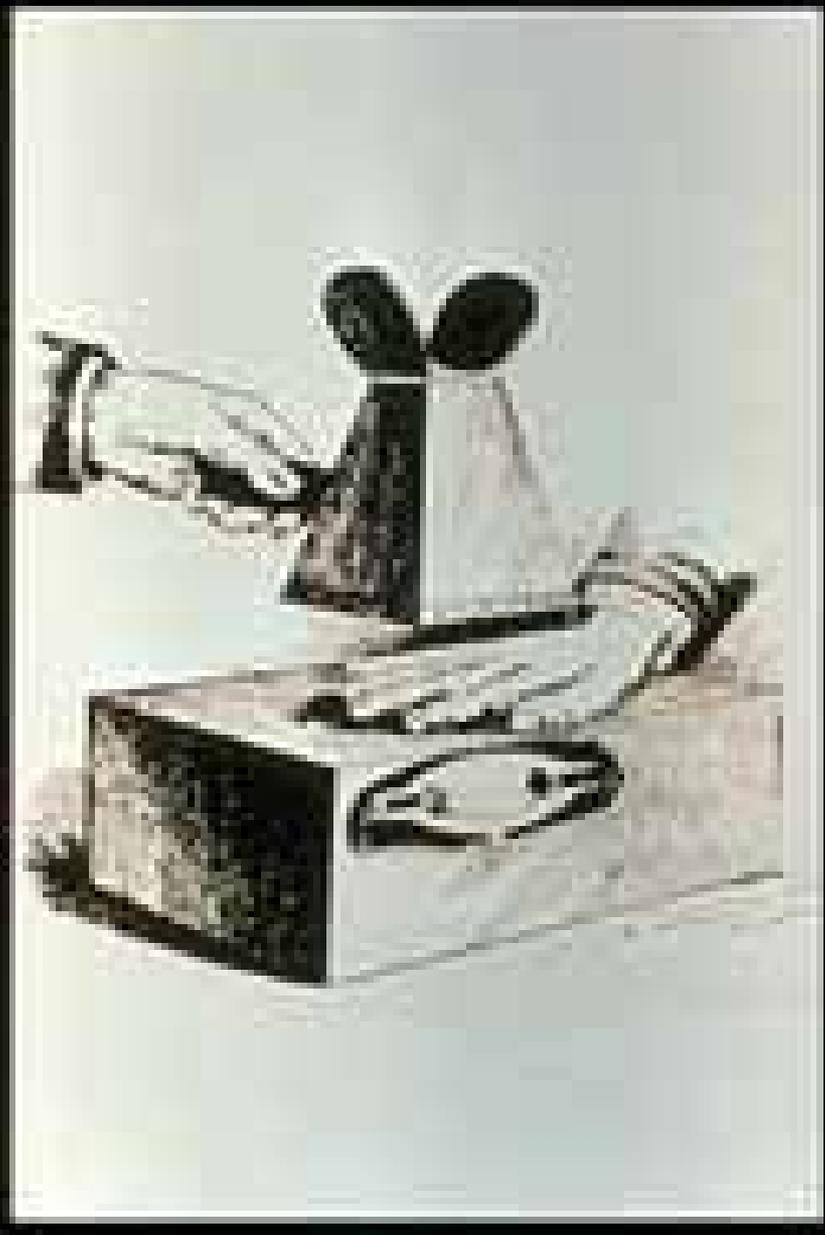


← 1903 Barcelona

## Electrorradiología

Hospital Provincial de  
Madrid –1903 →





**Rayos X portatil**

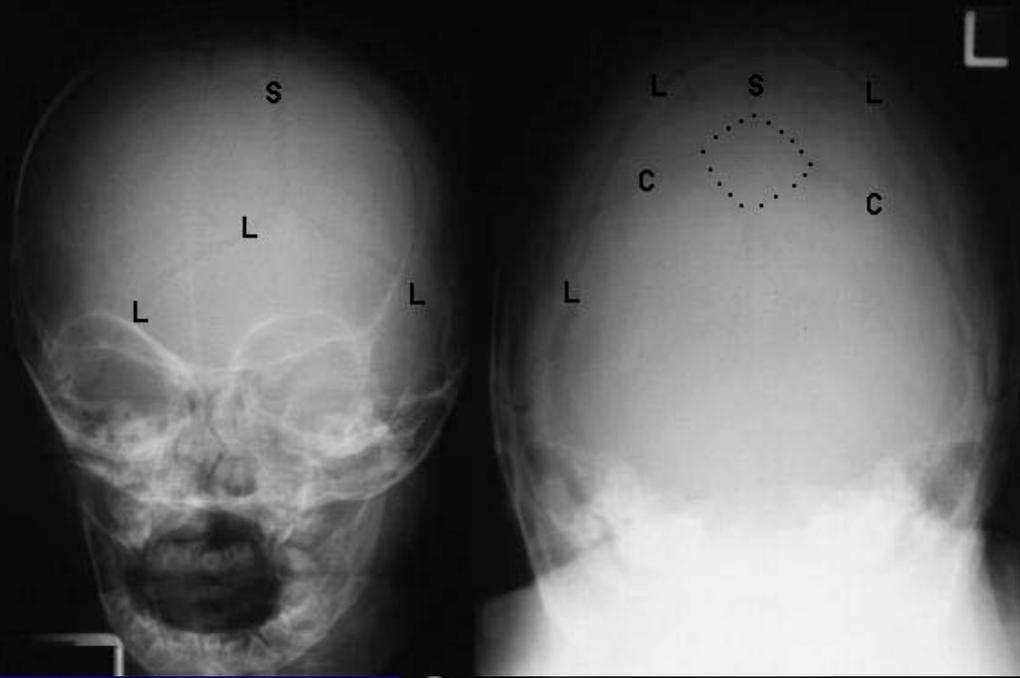


**Perdigones**

Absorción de rayos X según la densidad electrónica de las estructuras.

Imagen planar (superficial) de estructuras tridimensionales

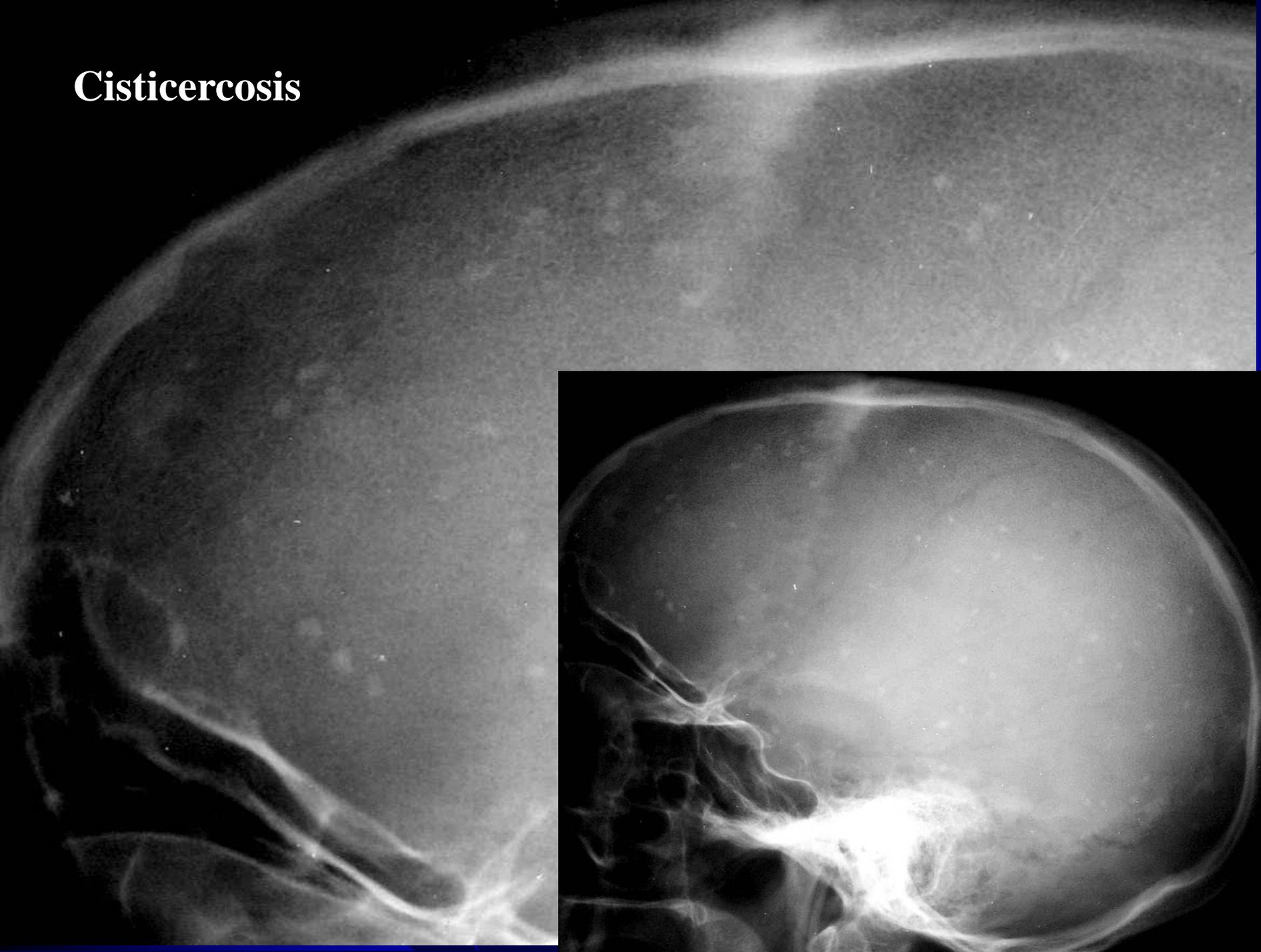








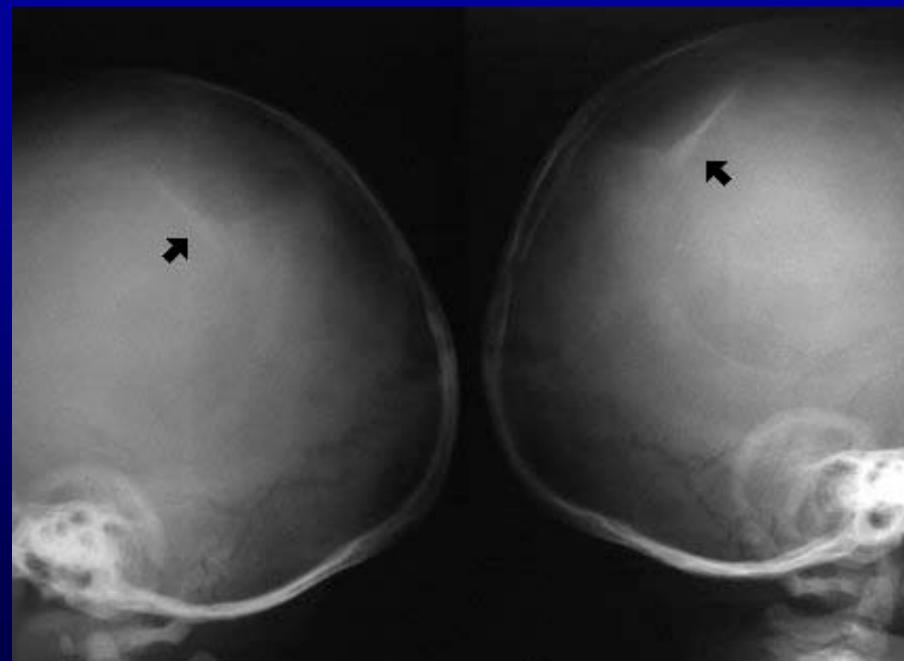
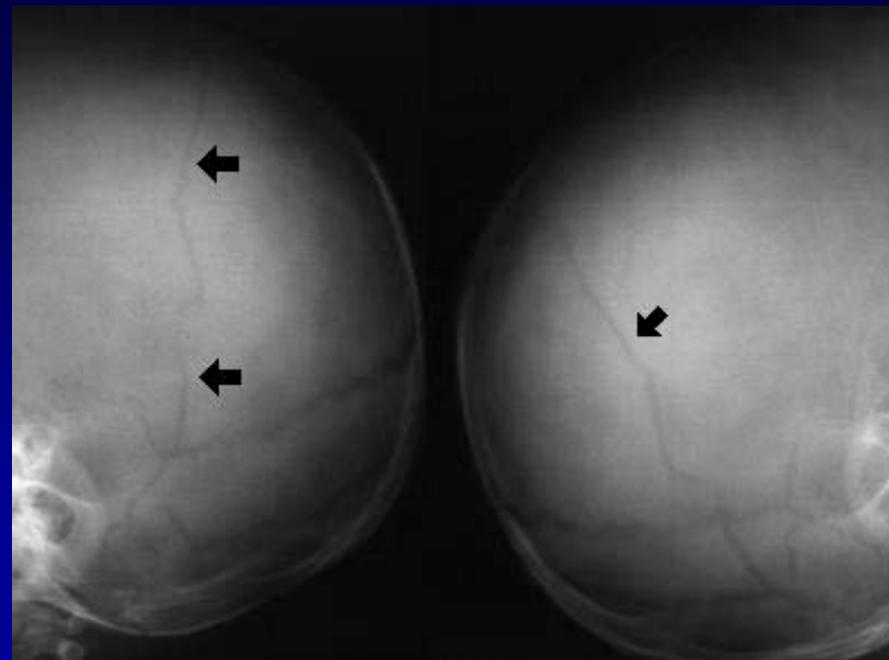
# Cisticercosis



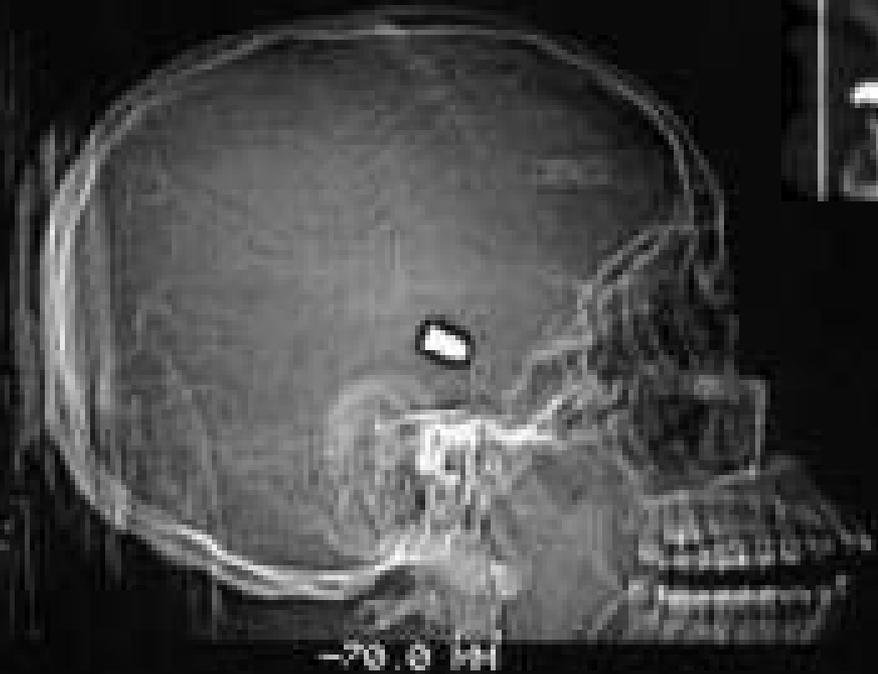


**Sturge Weber** “calcificaciones girales”

# Fracturas

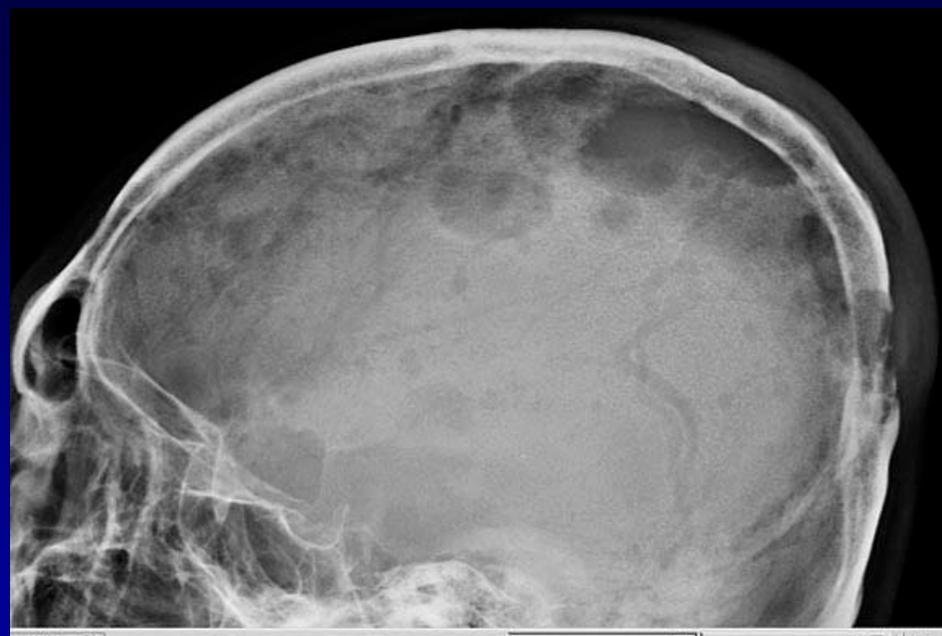


# Cuerpos extraños

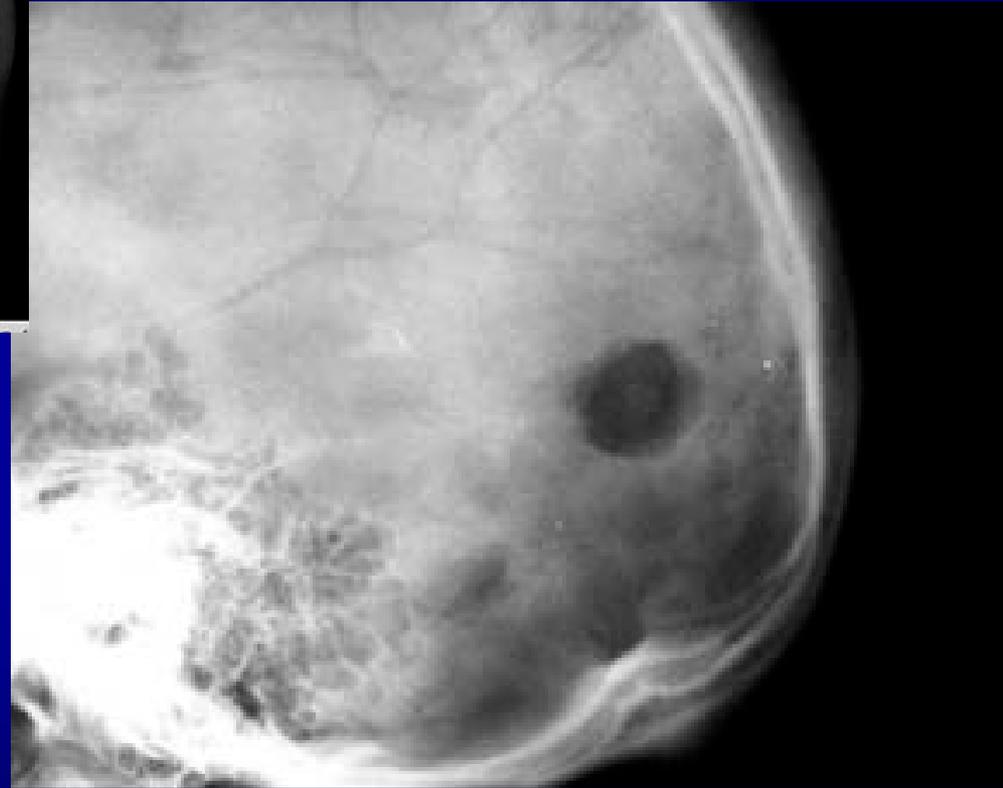


← Bala

# Lesiones destructivas óseas



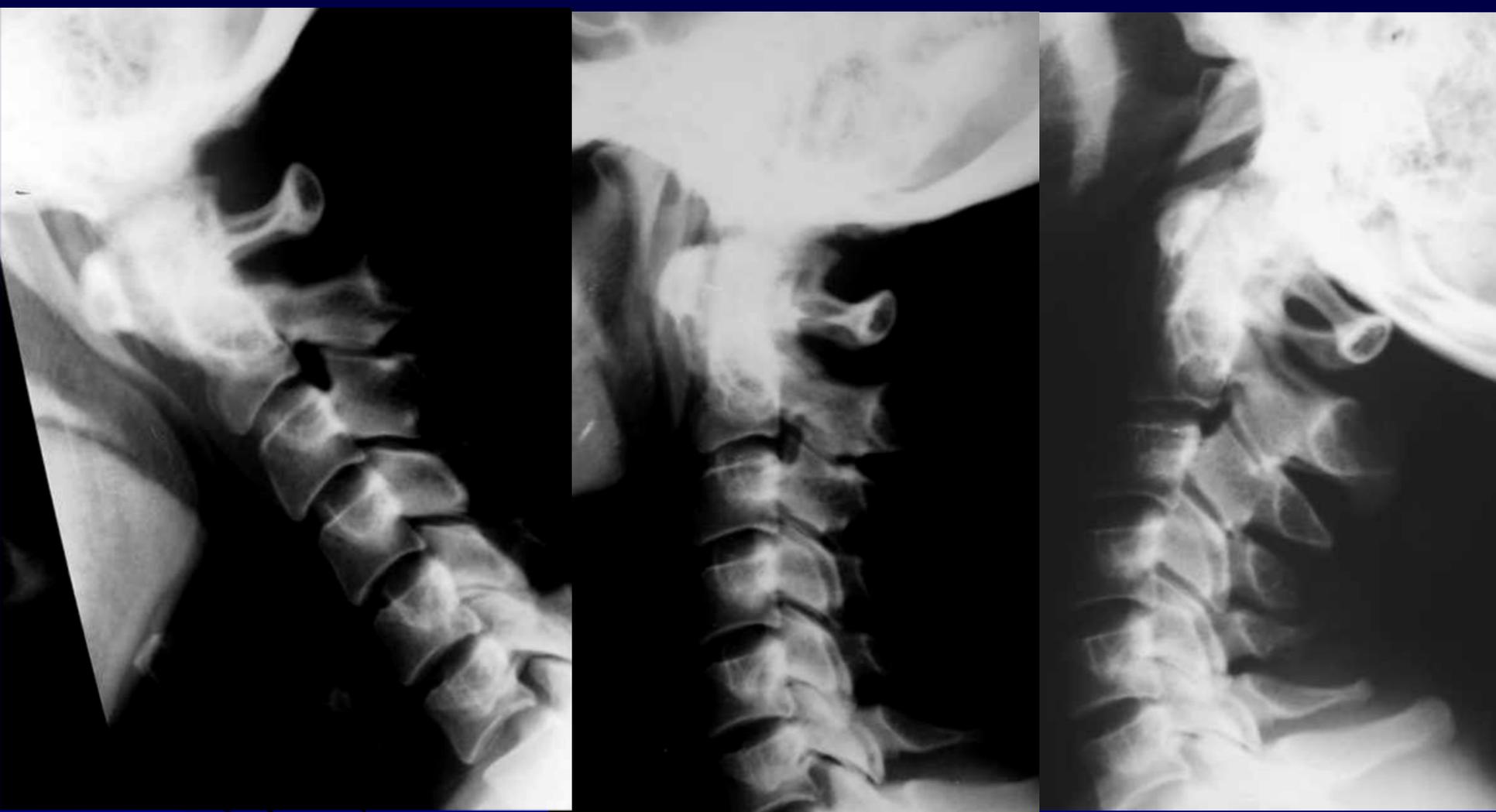
Mieloma



Granuloma eosinófilo



← Adenoma cromófono hipófisis



Estudios dinámicos en flexión anterior, neutra y extensión

# Pneumoencefalografía



Pneumoencefalografía  
Dandy 1918

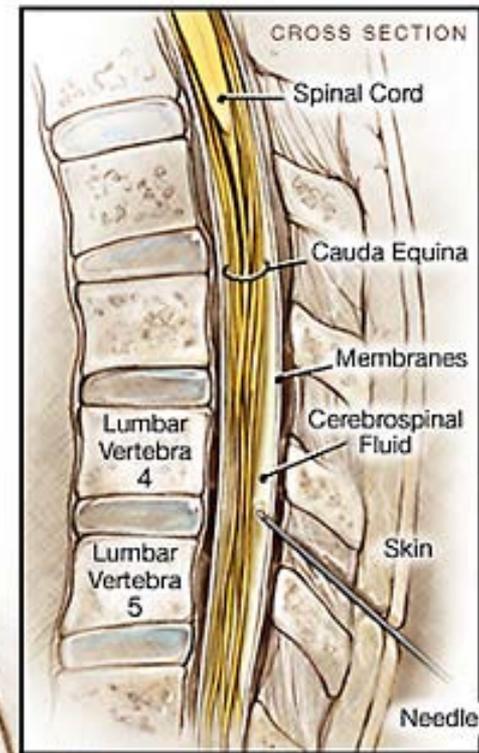
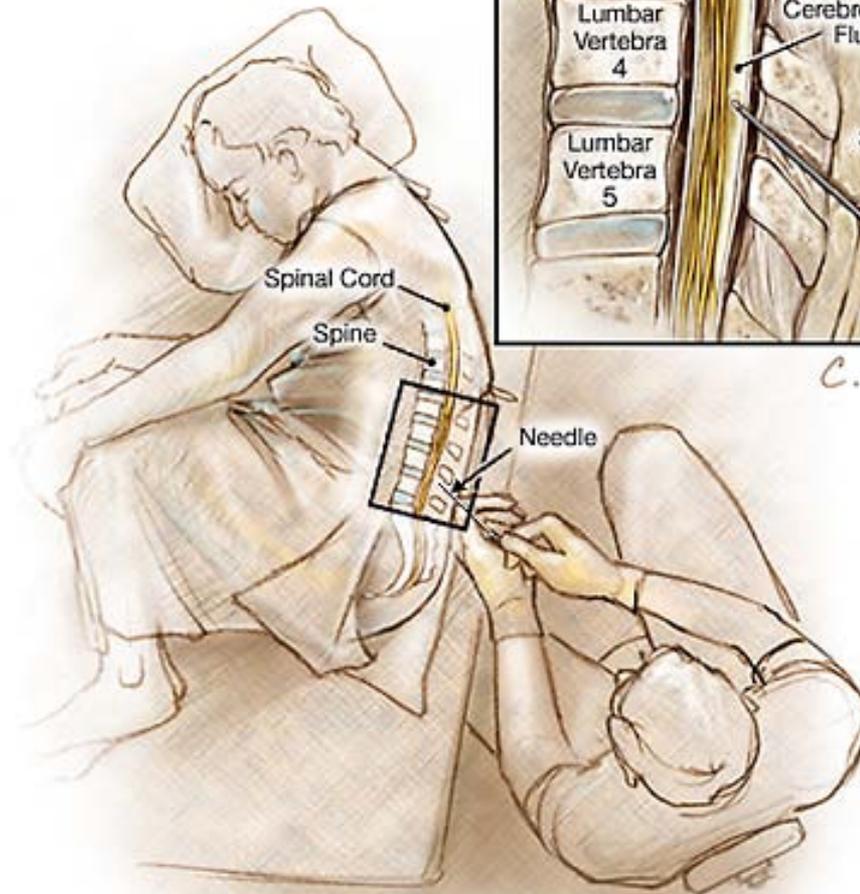
# Punción lumbar



**L.C.R.**

(Líquido cefalorraquídeo)

Lumbar Puncture  
TOP VIEW



C. Lynn



**Hidrocefalia**

# Ventriculografía Cisternografía



Contrastes liposolubles

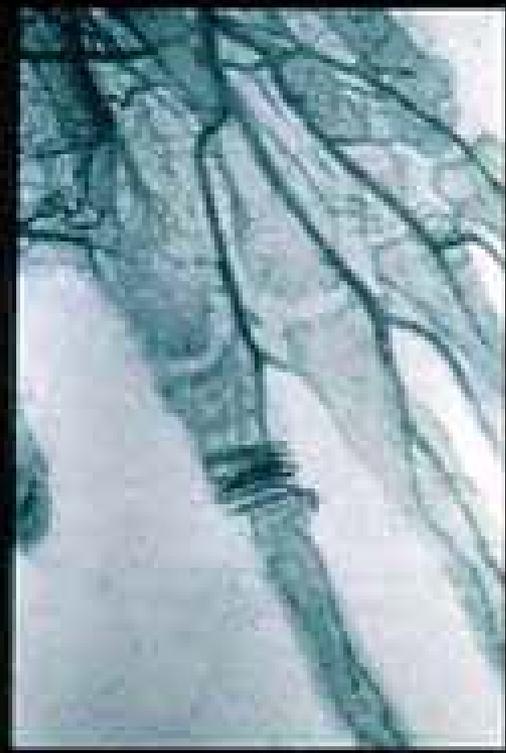
Mielografía  
Radiculografía  
Mielo TC  
Mielo RM



Contrastes hidrosolubles



# Arteriografía



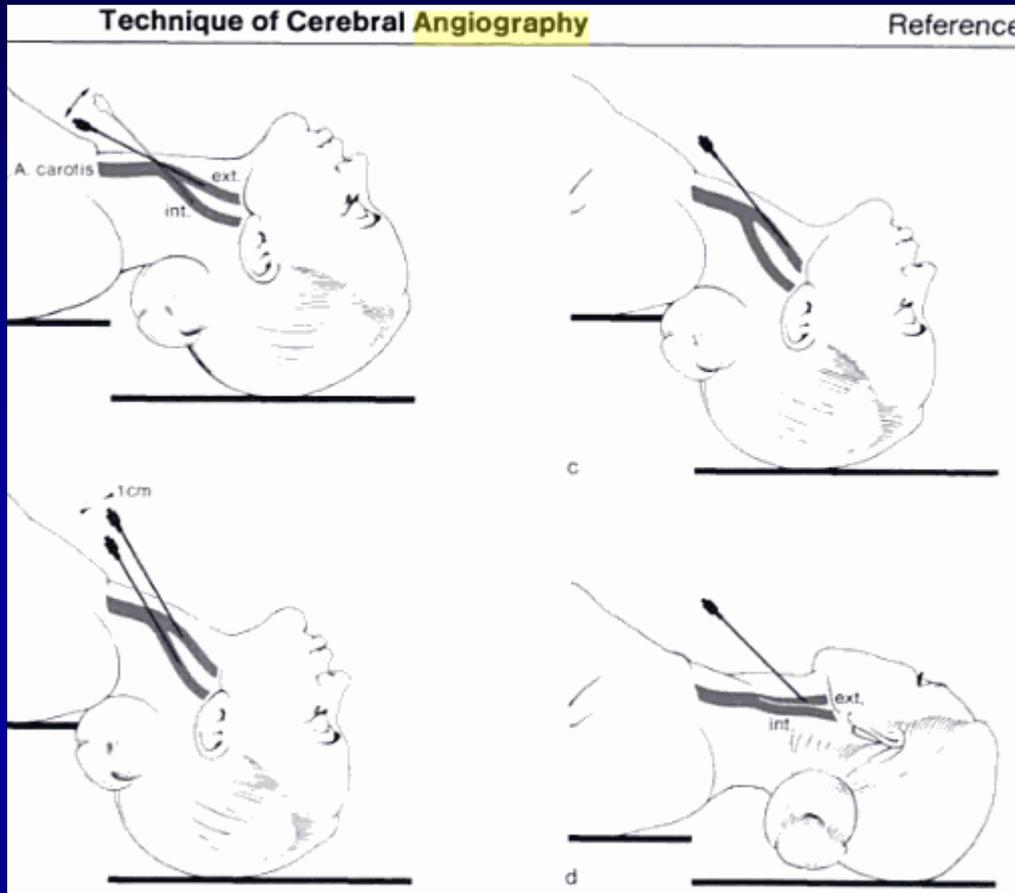
Post mortem  
1896 Mercuriales

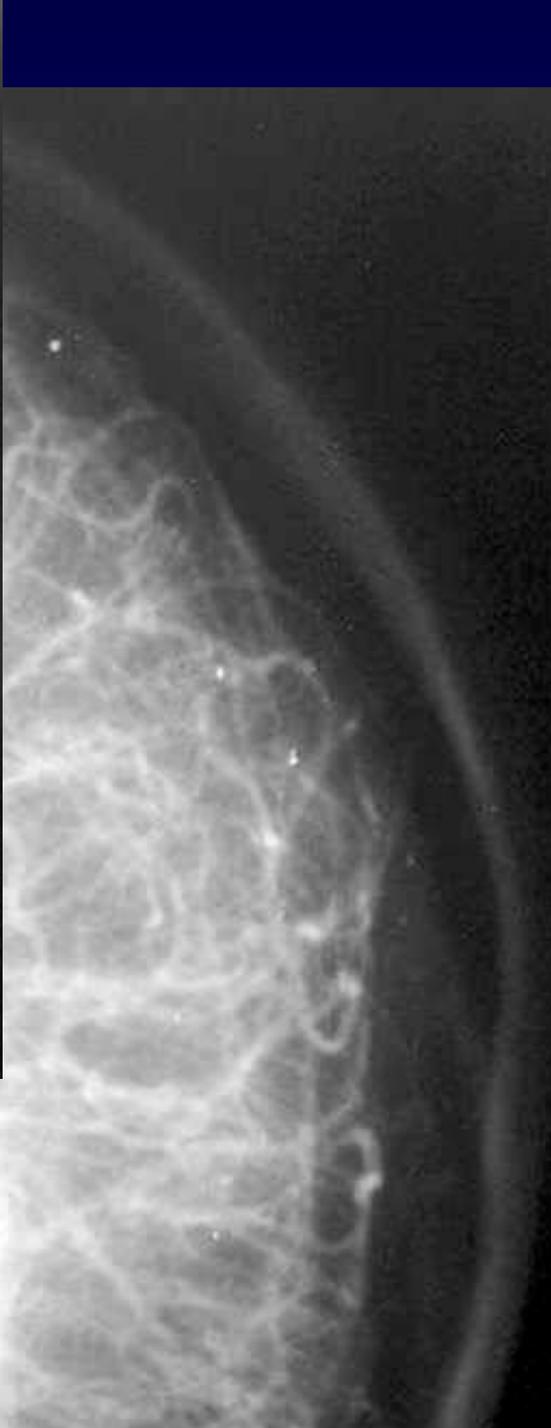
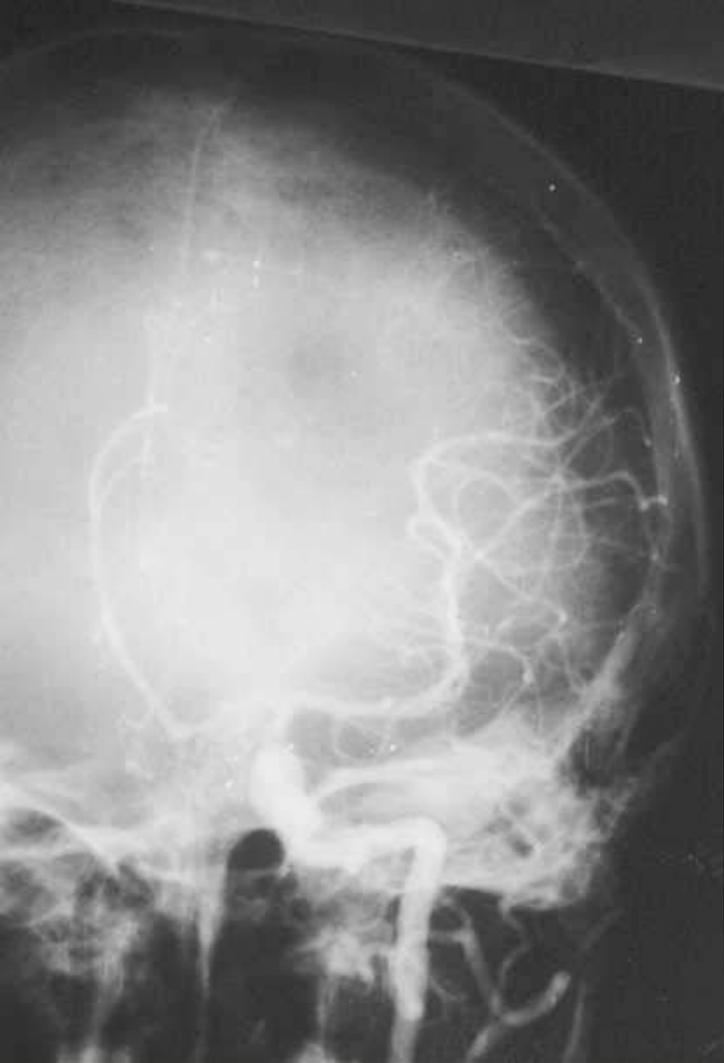


Antonio Caetano de Abreu Freire **Egas Moniz**

1931 → torotrast

P. Nobel 1949 Psicocirugía (Leucotomía o lobotomía frontal)



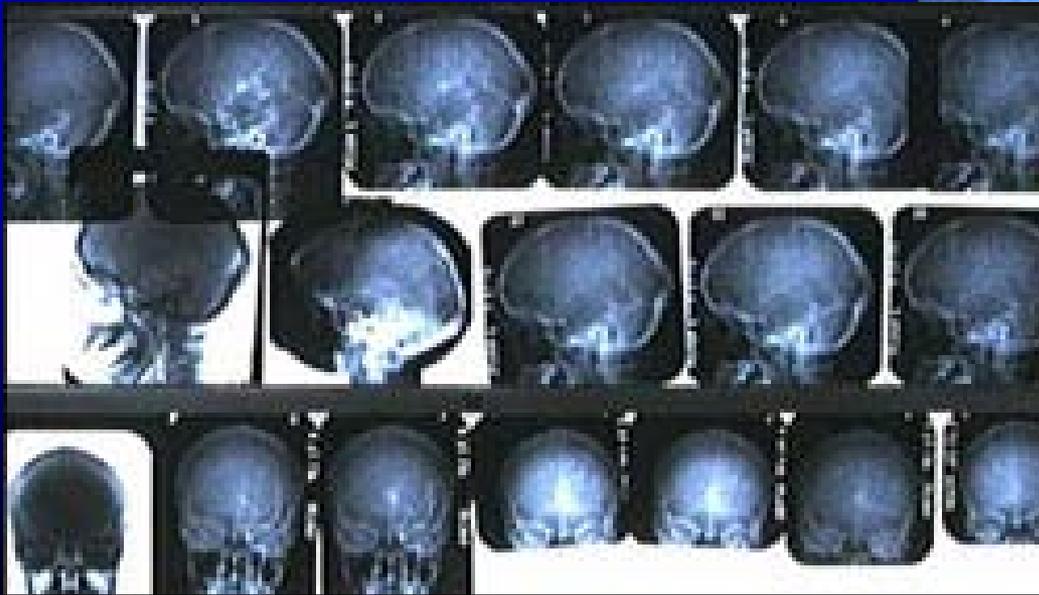


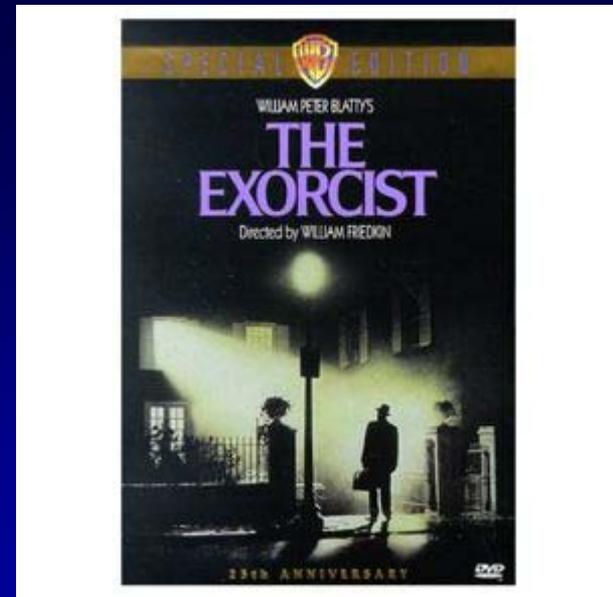
Arteriografía carotídea:

Hematoma subdural +  
herniación subfalciana



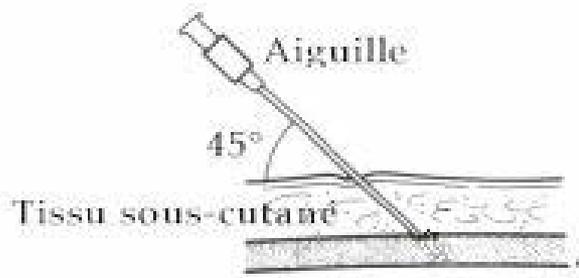
N.Y.U.



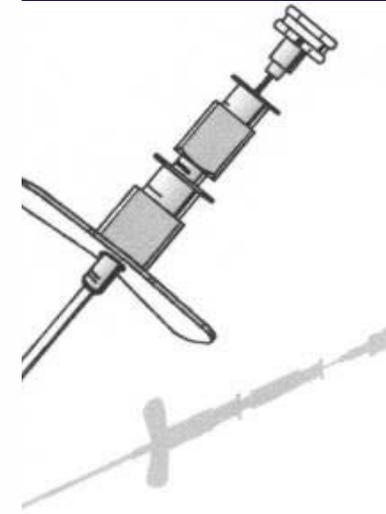
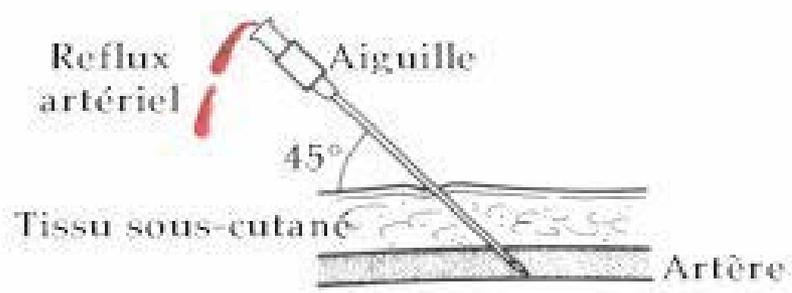


Linda Blair en "El exorcista" 1973

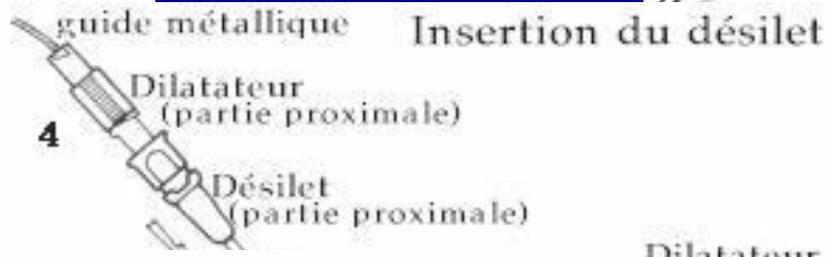
1



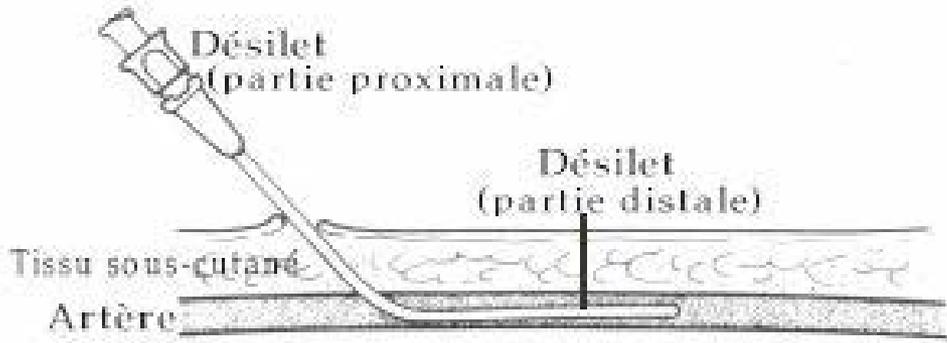
2



3



5



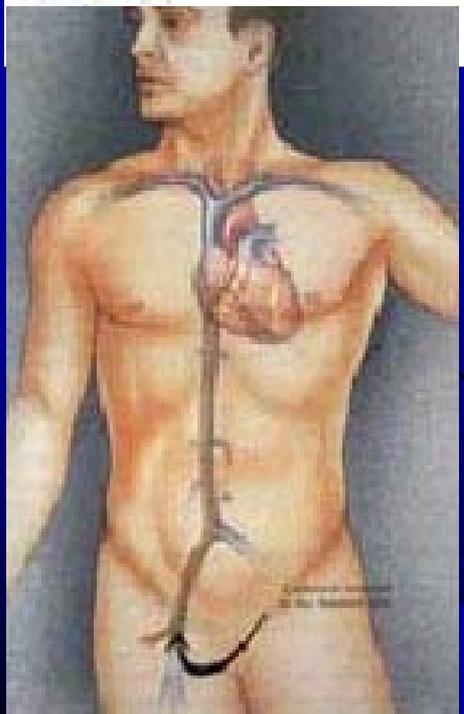
Técnica de  
Sven Ivar Seldinger  
Percutánea 1953

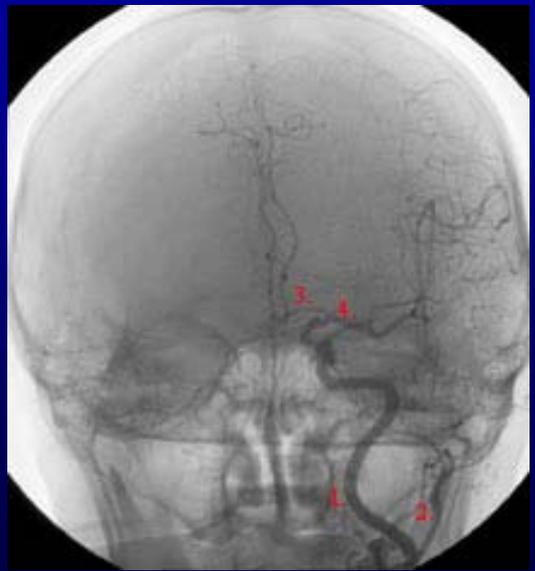
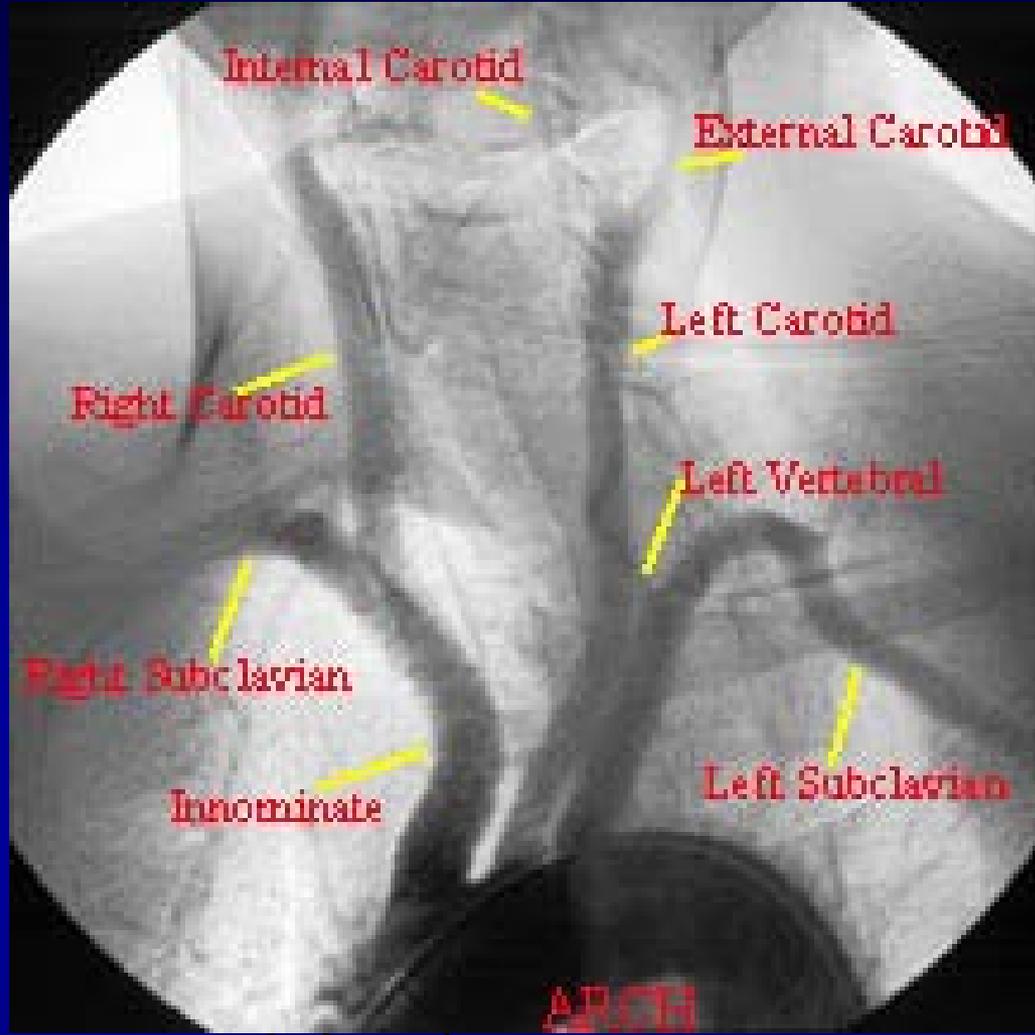
Pigtail  
Sideholes  
Aorta

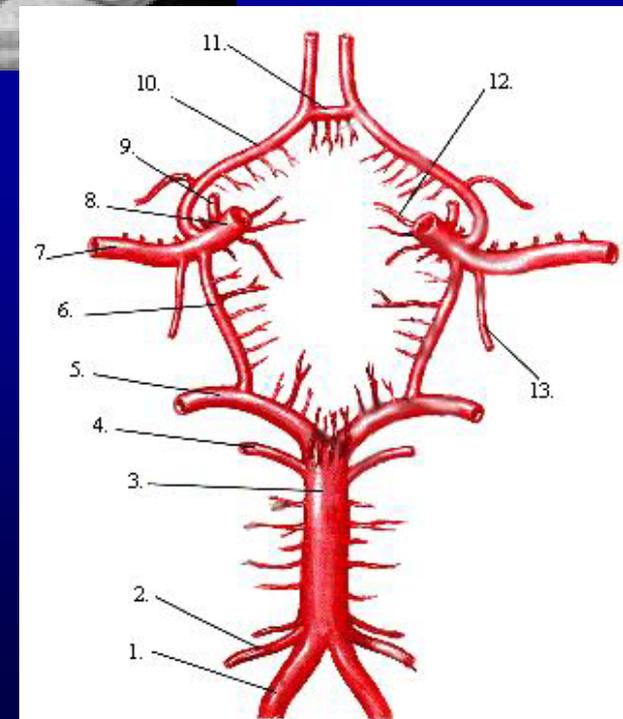
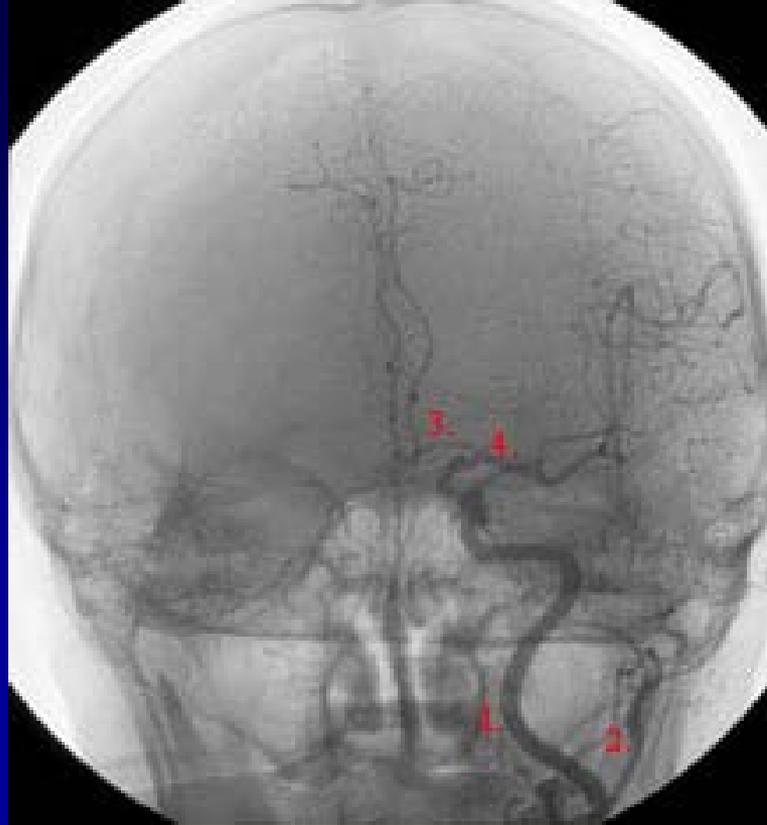
Straight  
Sideholes  
Endhole  
Multipurpose

Headhunter  
Endhole  
Cerebral

Simmons  
Endhole  
Cerebral  
Visceral

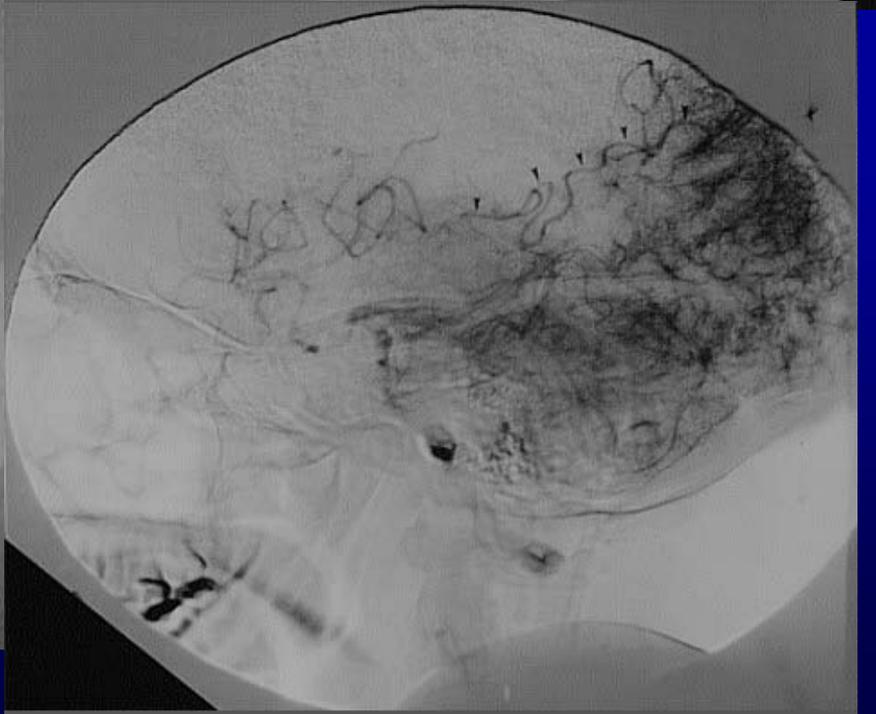
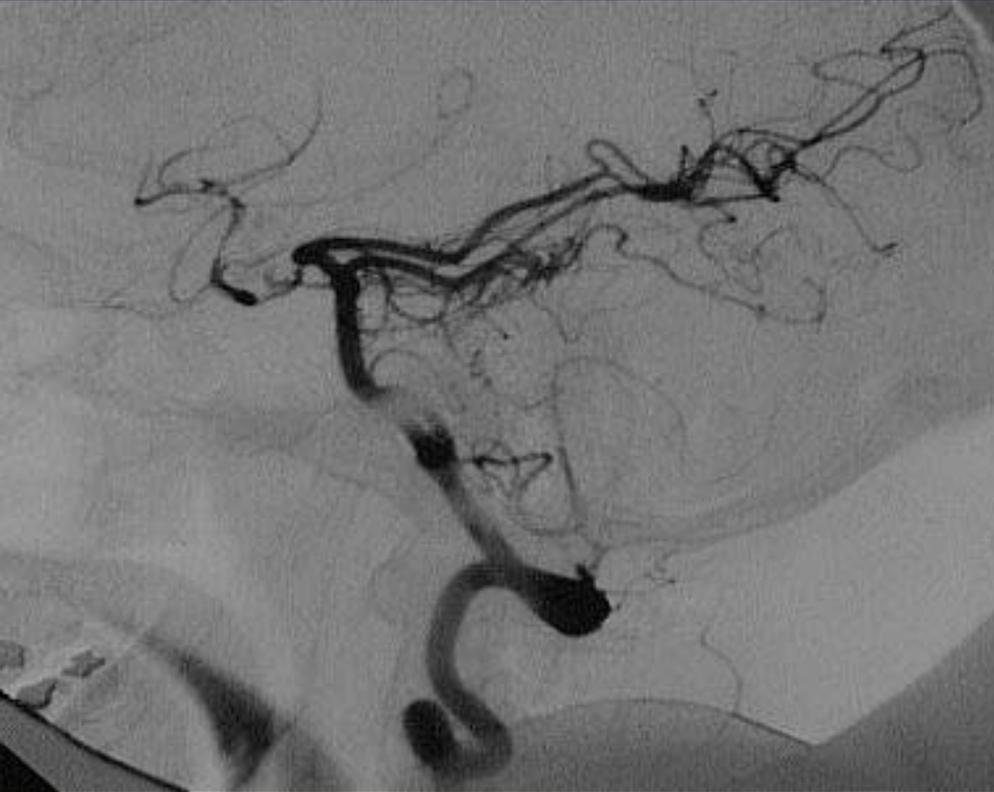


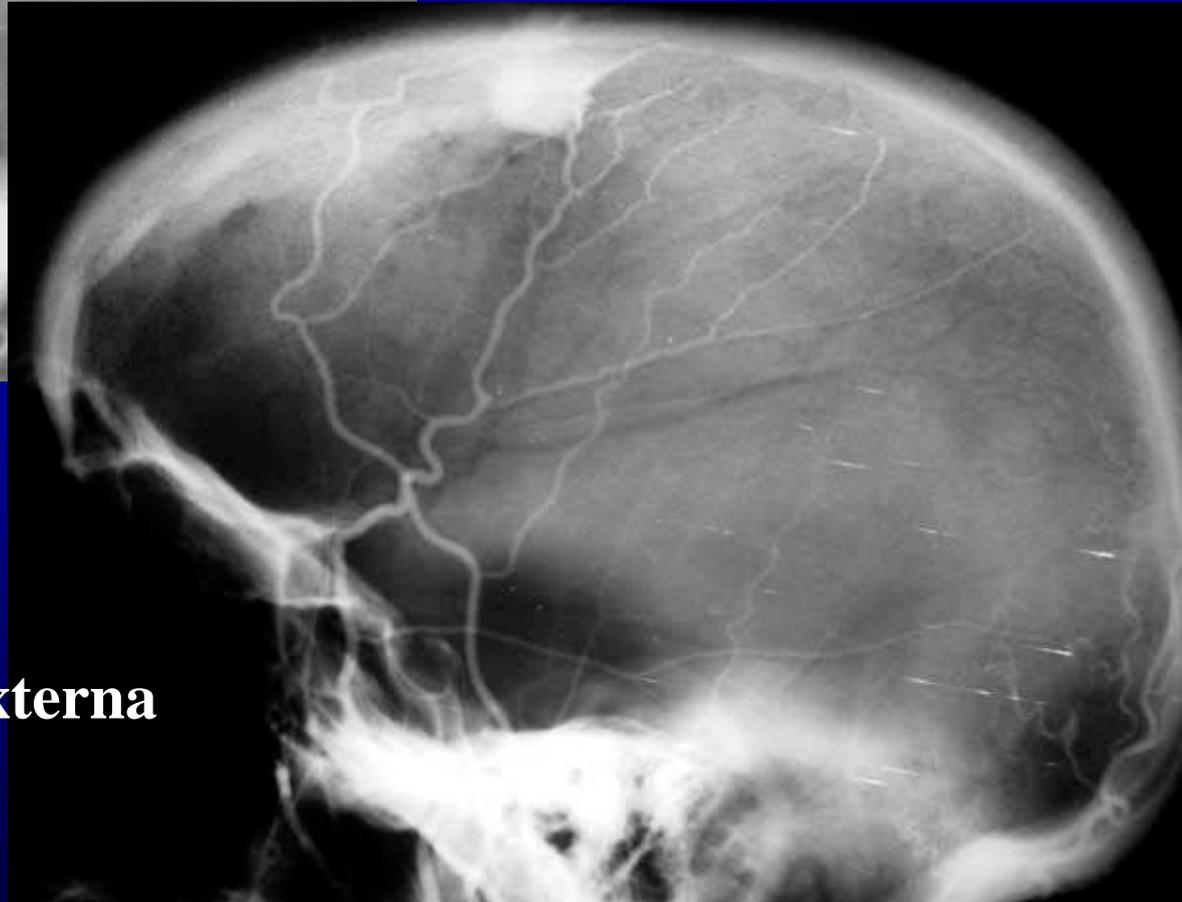
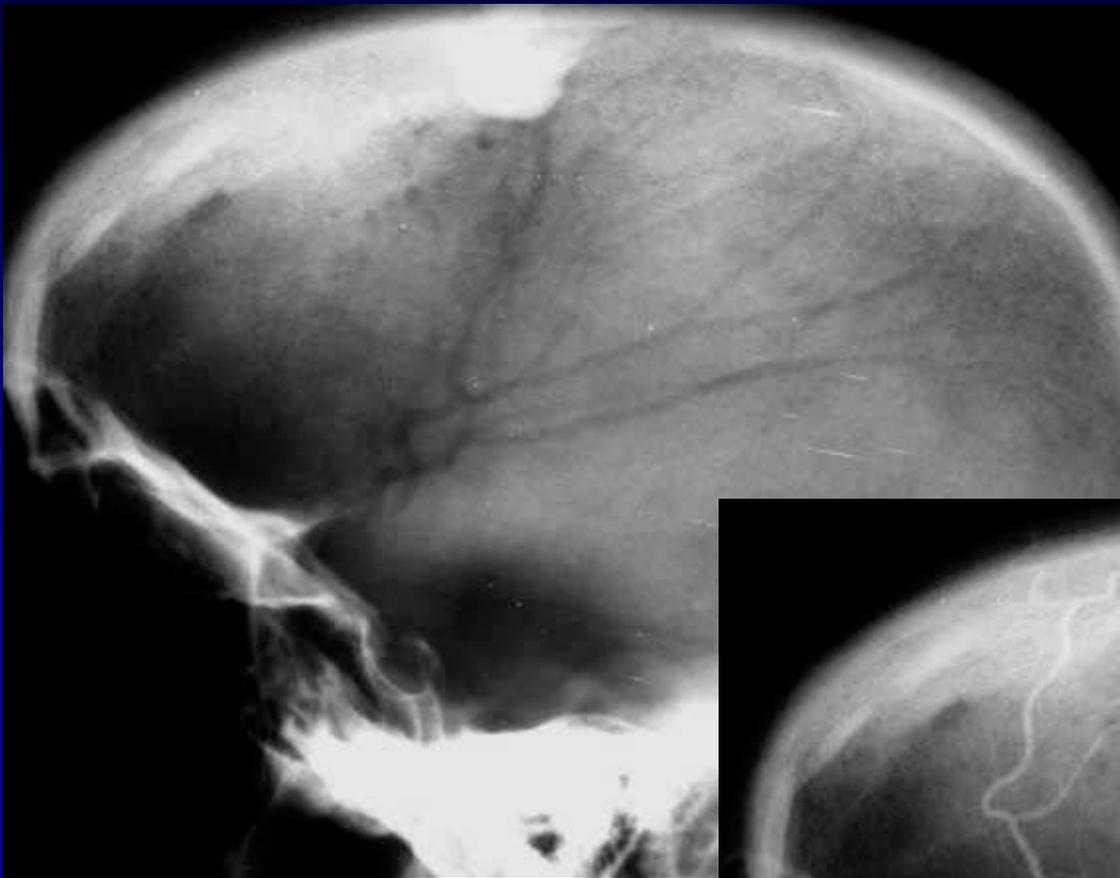




**Arteriografía carotida Izquierda**

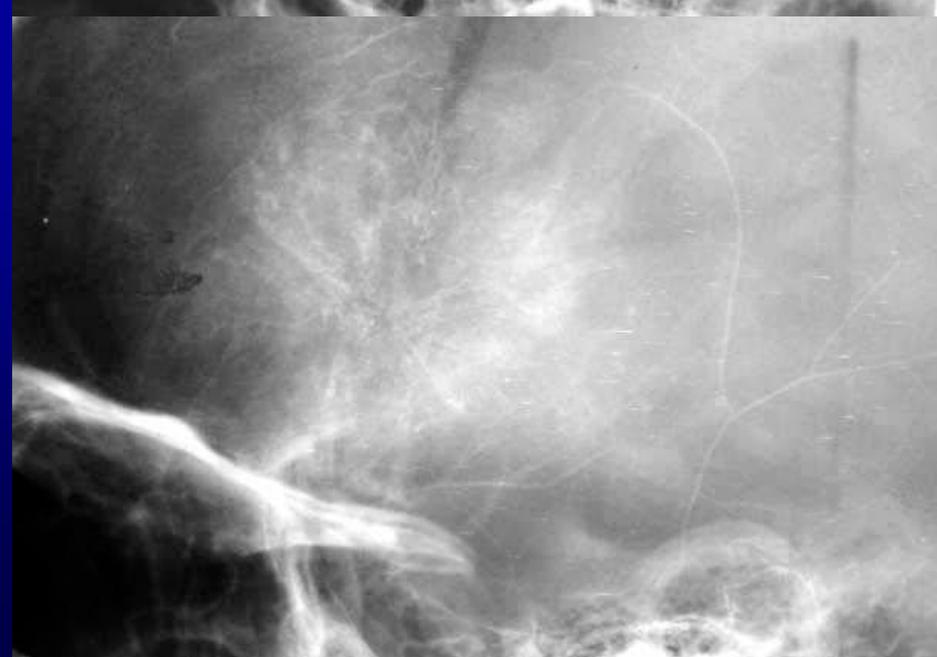
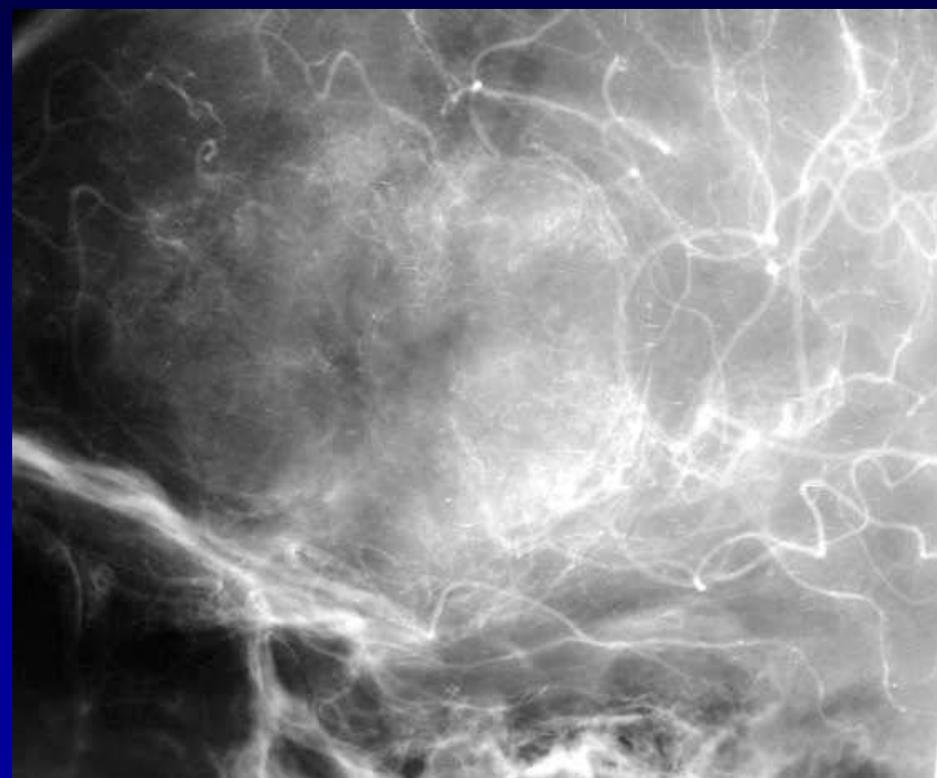
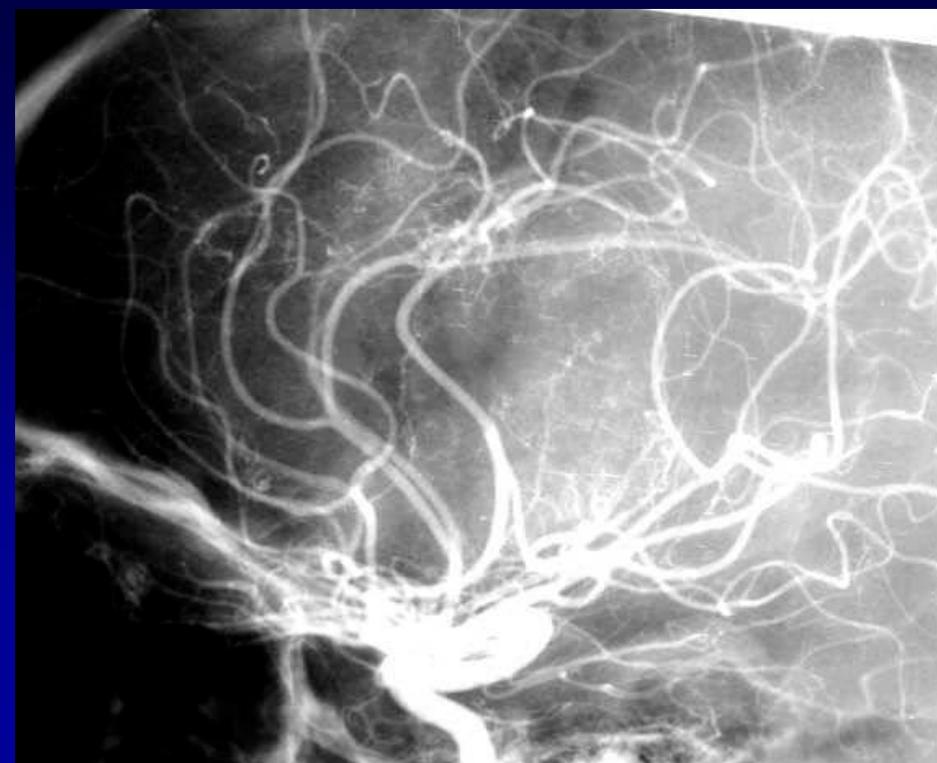
# Arteriografía vertebral



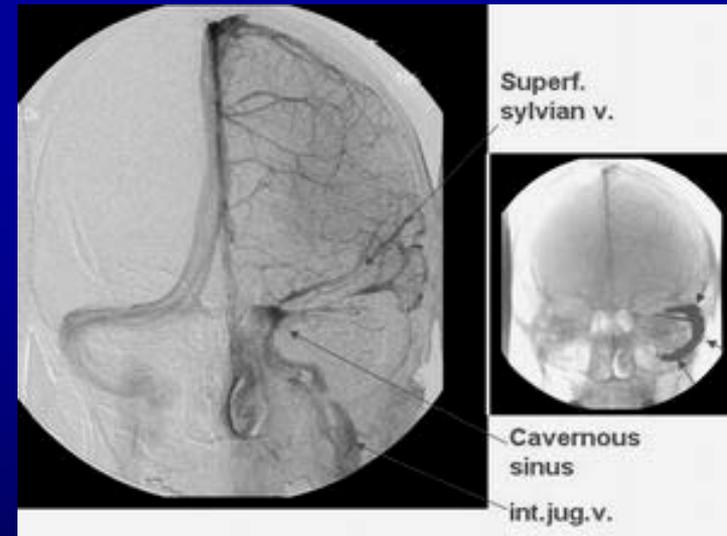


**Arteriografía carótida externa  
en meningioma**





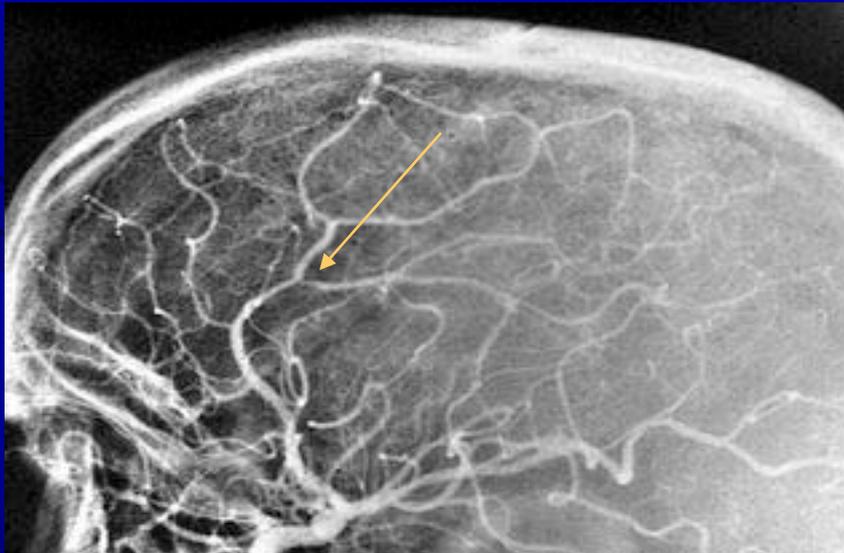
# Venografía



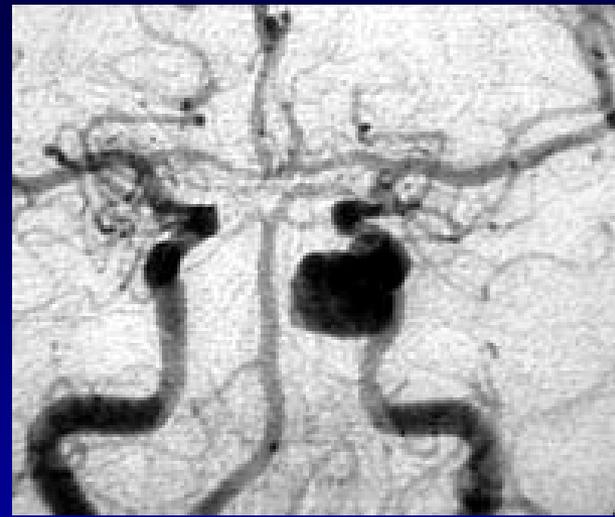
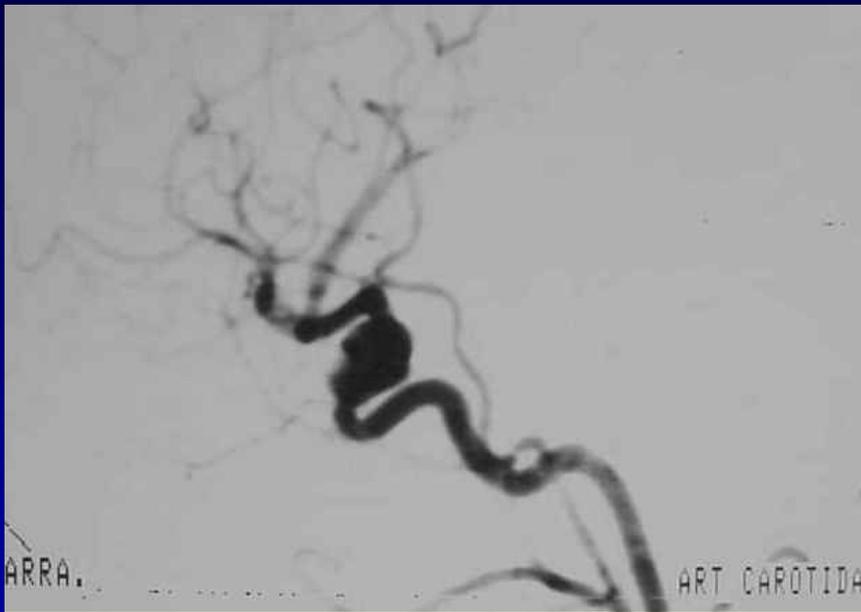


← Obstrucción cerebral media

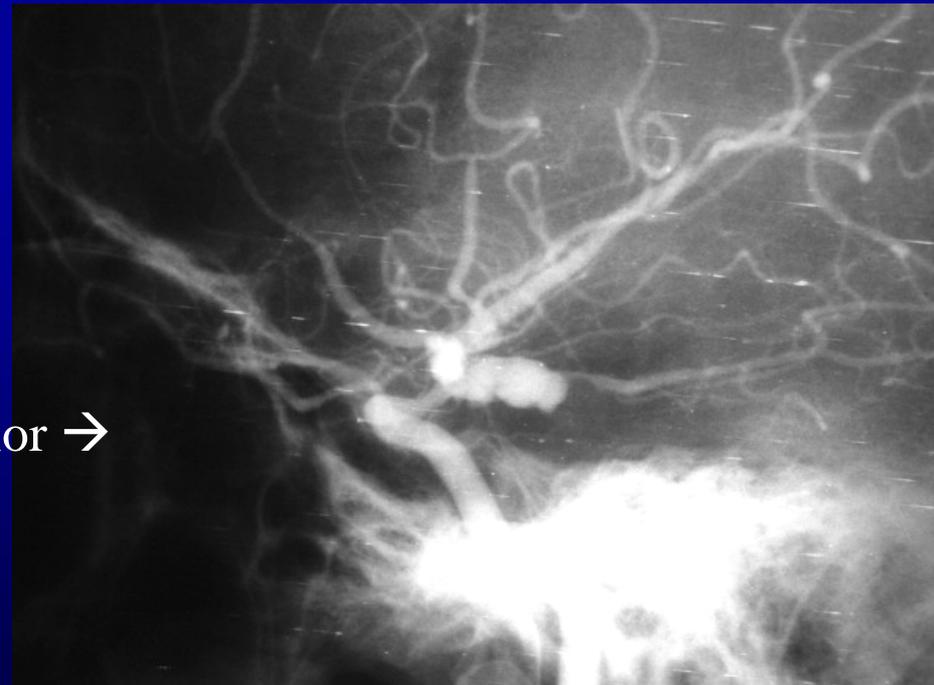
## Aortografía y Angiografías selectivas o punción directa

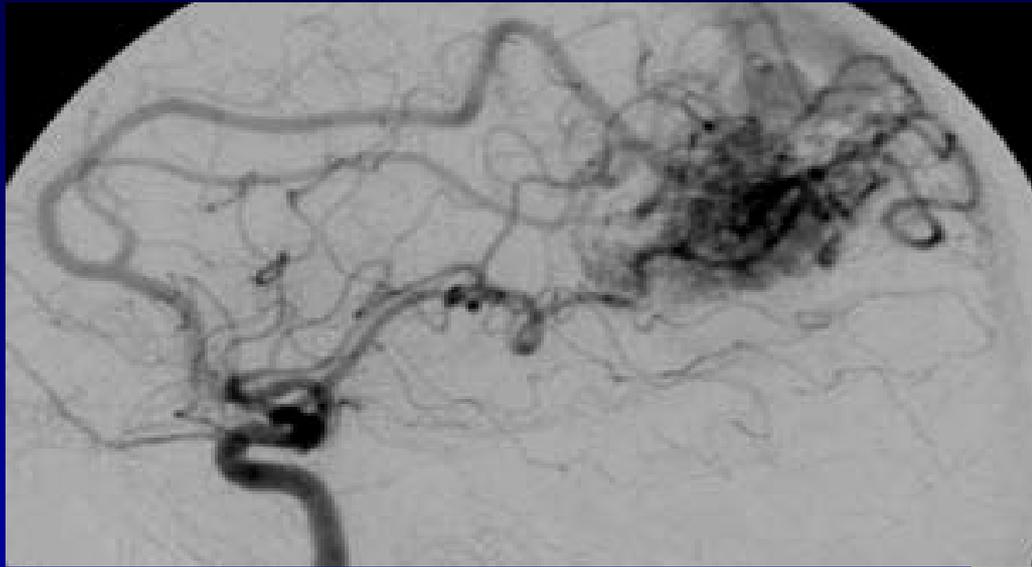


← Estenosis pericallosa

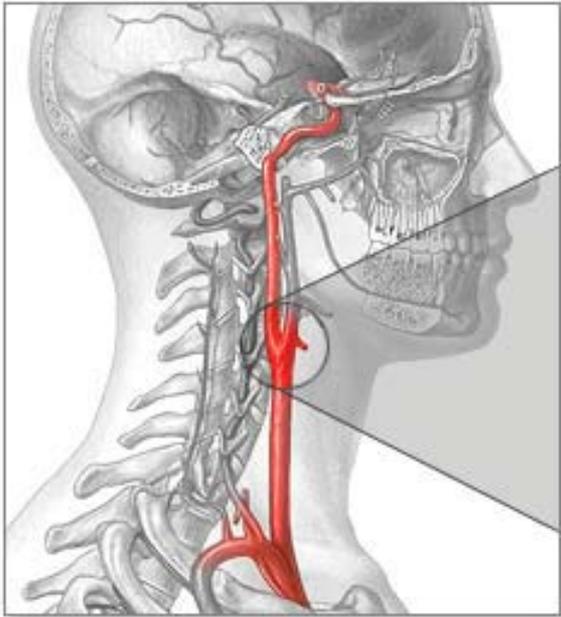


Aneurisma de Comunicante Posterior →

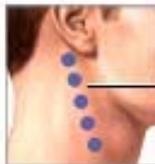




**Malformación arteriovenosa**



Atherosclerotic plaque



Neck incision



Incision of



Plaque removed



Artery repaired

Before



After



Charles T. Dotter (1920-1985)



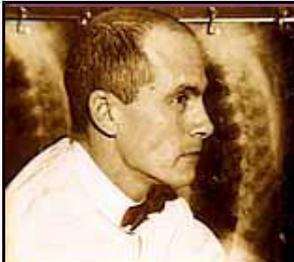
OREGON HEALTH & SCIENCE UNIVERSITY

Portland

Melvin Judkins

angioplastia transluminal 1964

# Balloon Dilatation Catheters



Mujer de 83 años con obstrucción de arteria femoral superficial.  
Angiografía diagnóstica → terapéutica



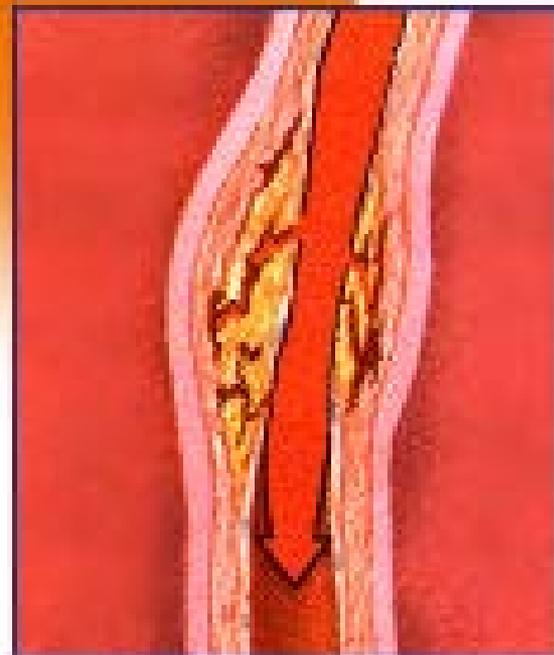
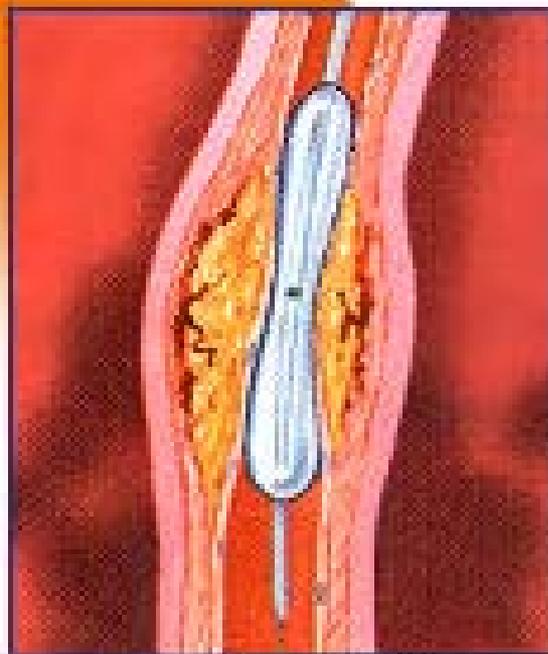
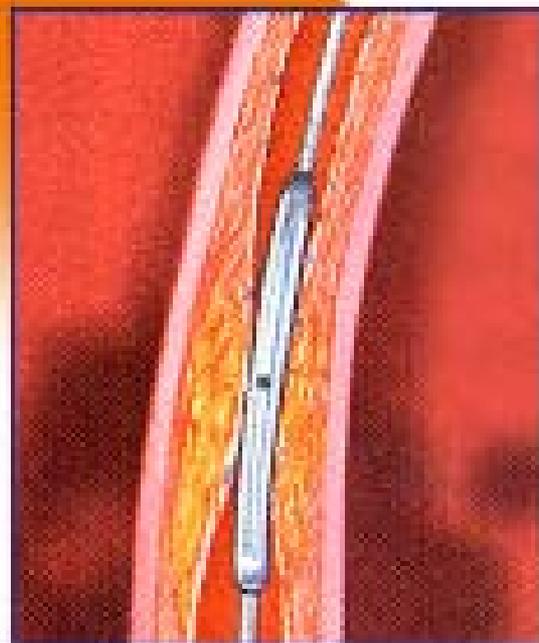
8 semanas despues



Charles T. Dotter "logo"

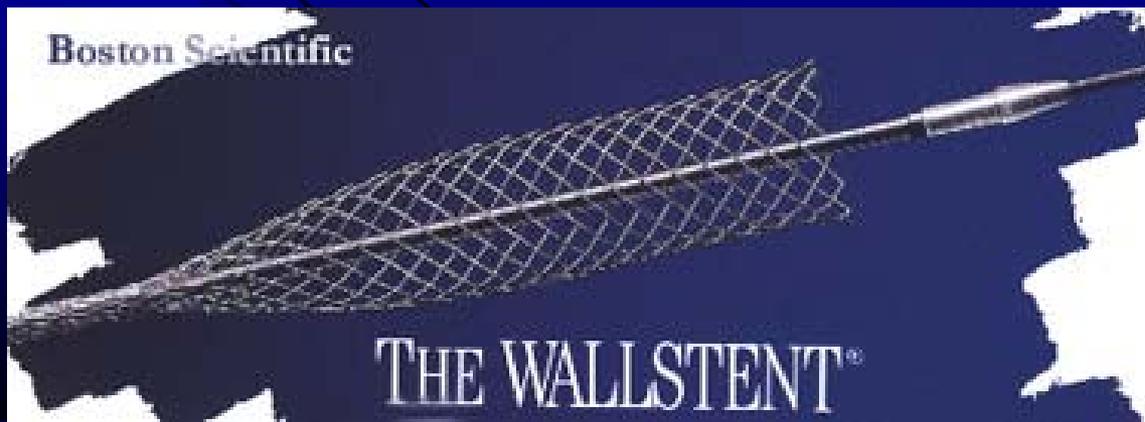
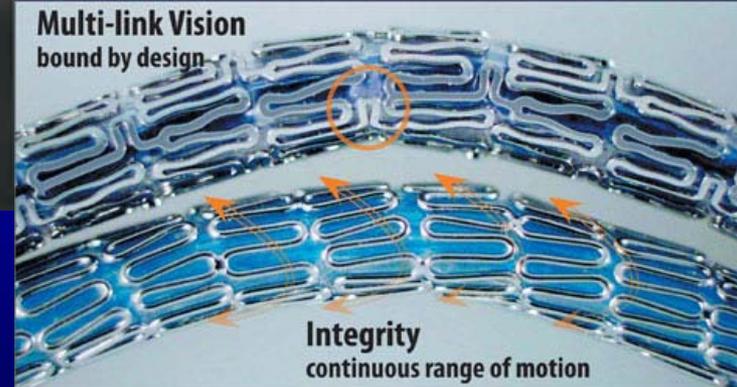
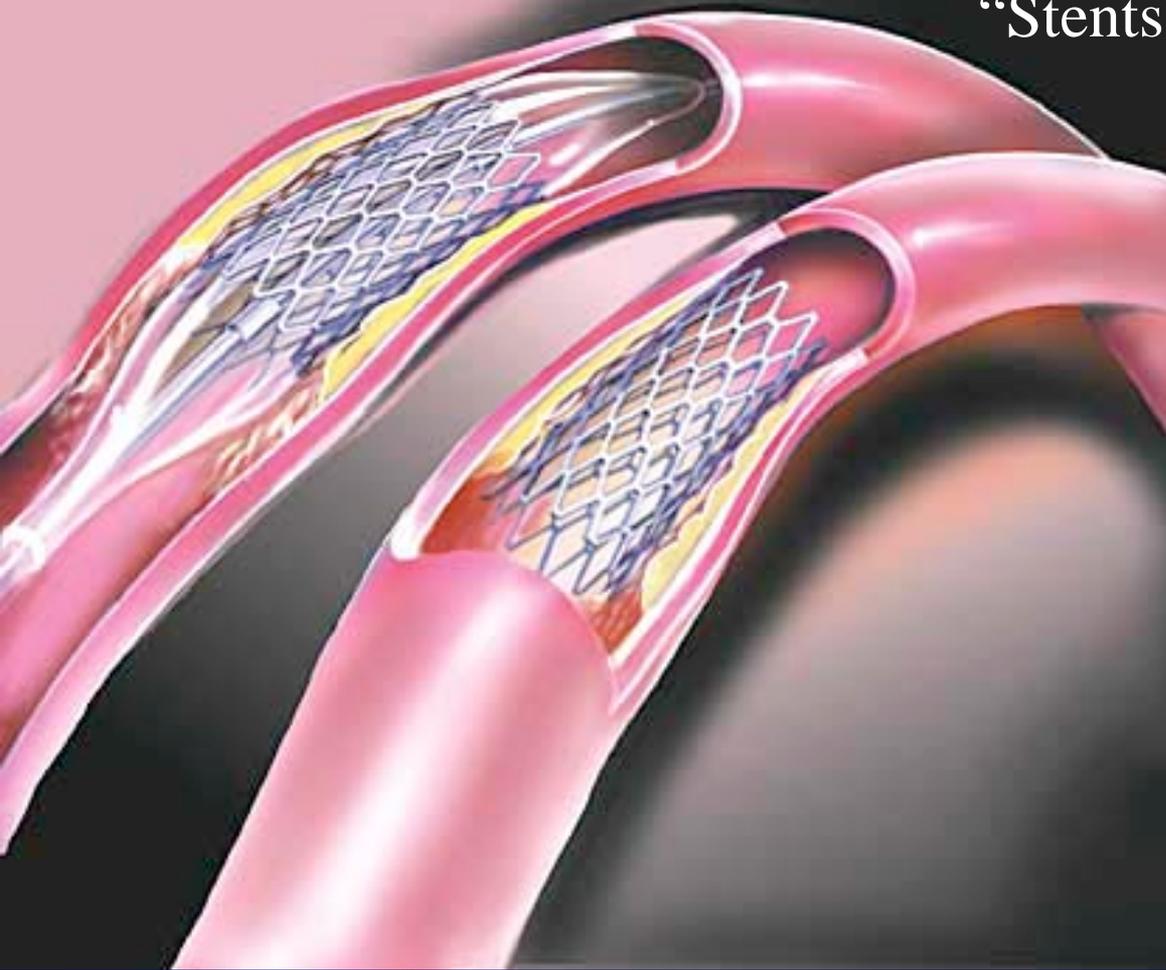
Dr. Josef Rösch 1968 "TIPSS"

Andreas Gruentzig 1977 angioplastia coronararia



# “Stents” o implantes endoluminares

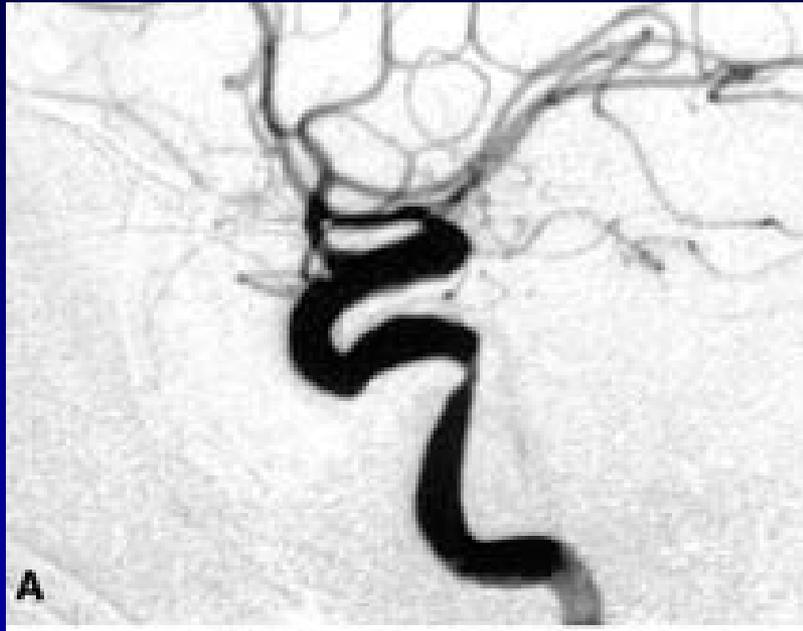
Charles Thomas Stent (odontólogo)

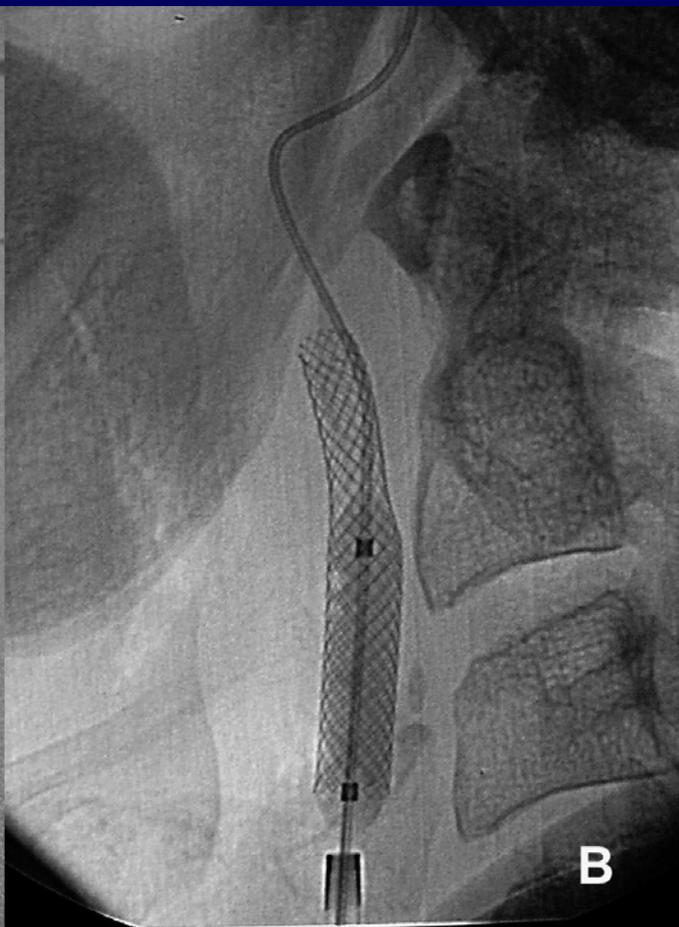


Liberador de fármacos o farmacoadactivos

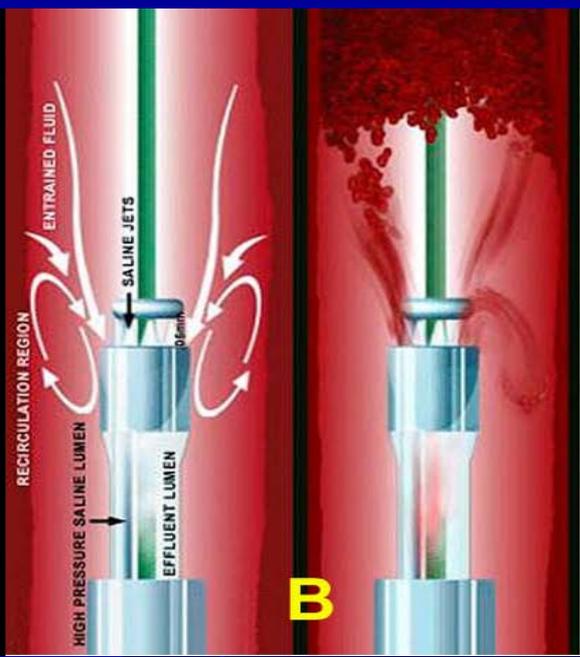


**Post stent**

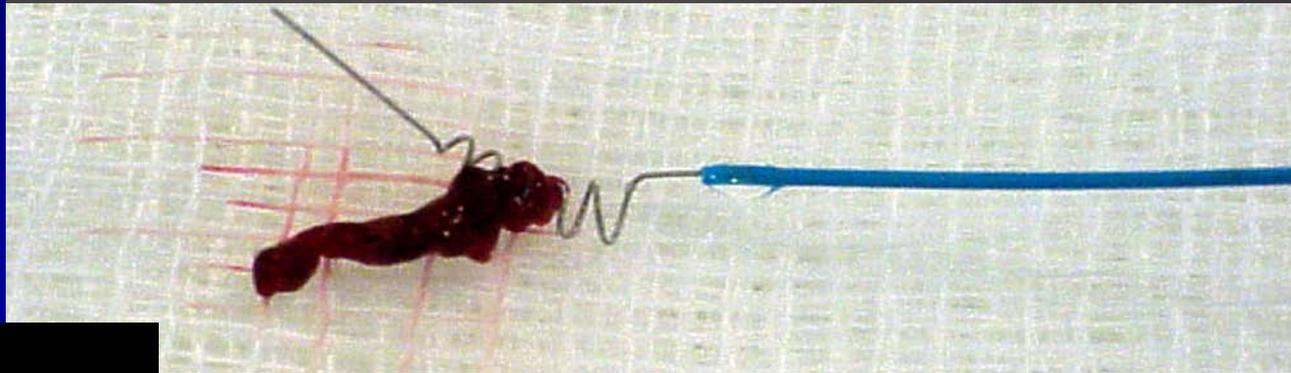




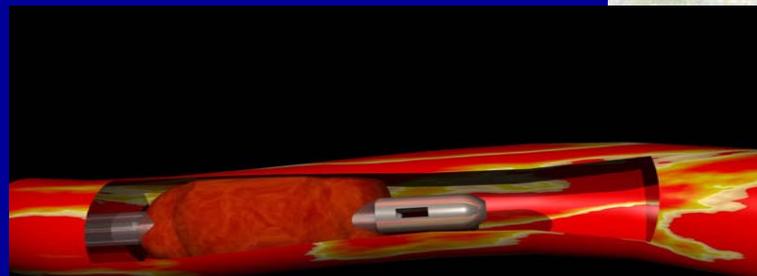
Post "stent"



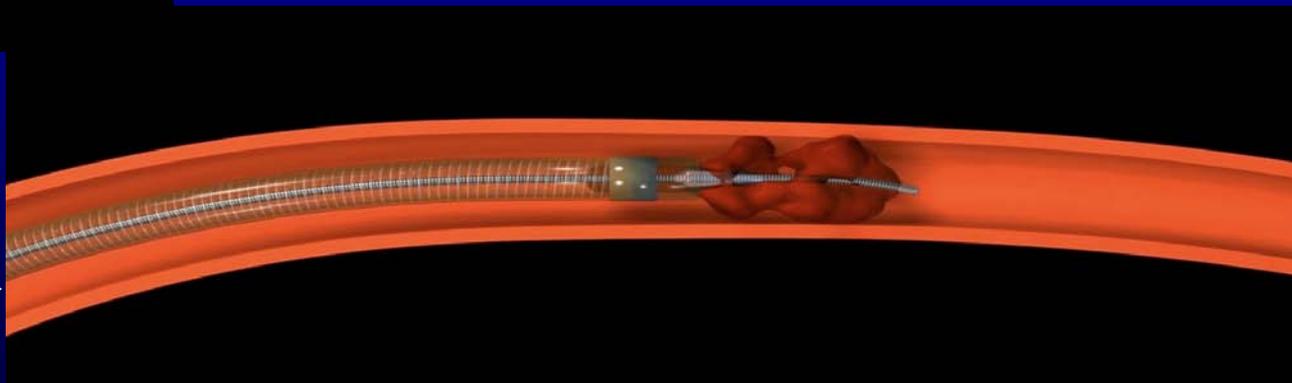
MERCI →

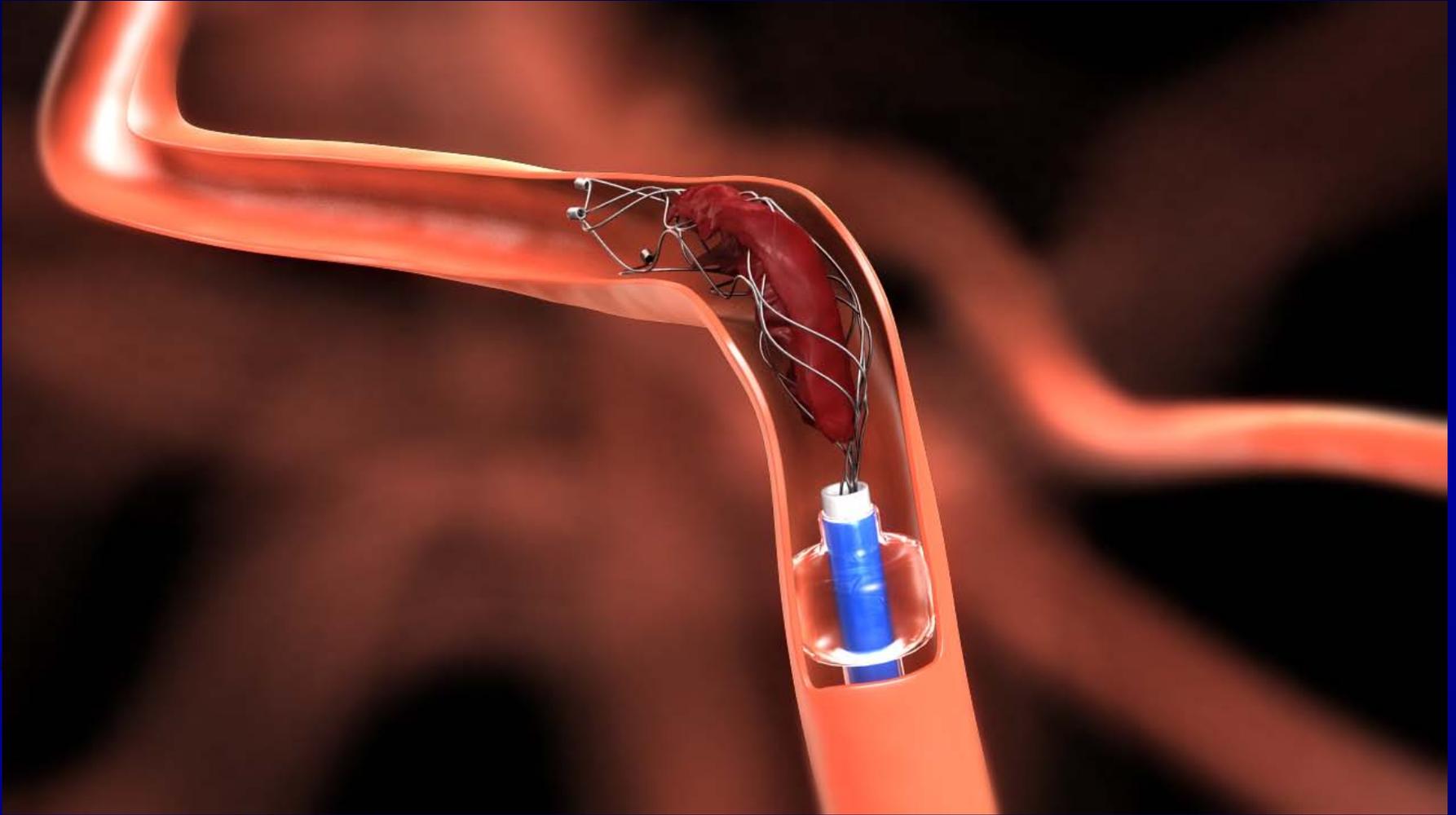


← Ultrasonidos

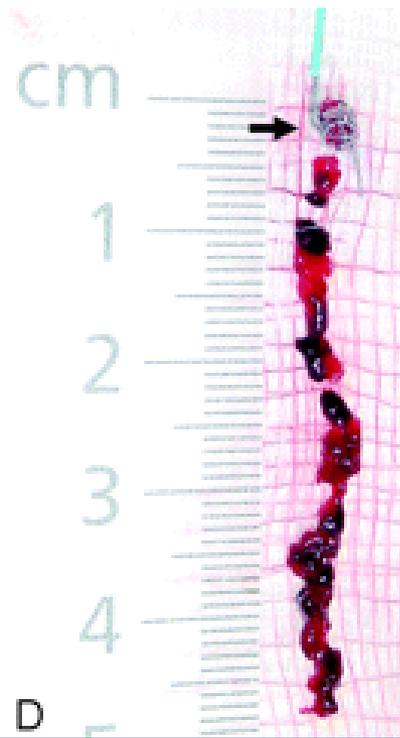
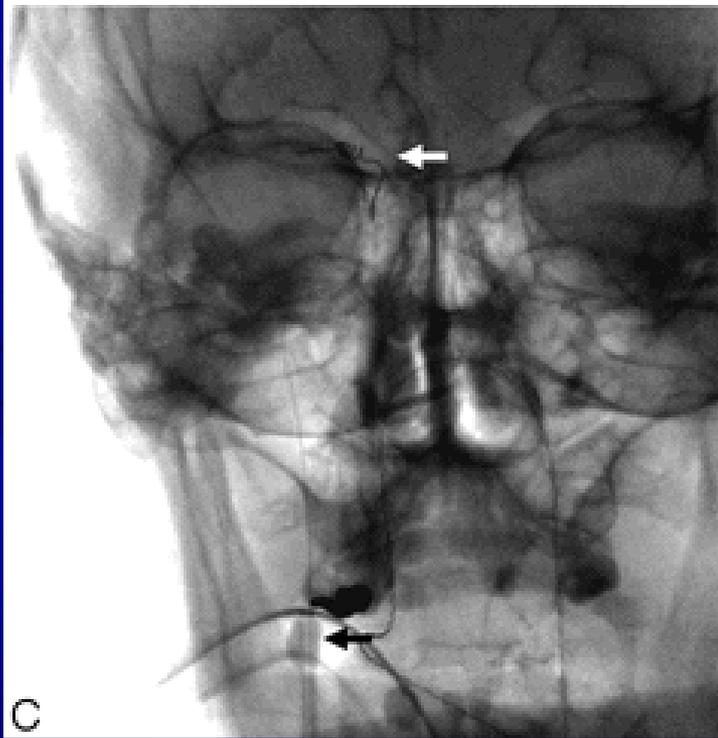


PENUMBRA →



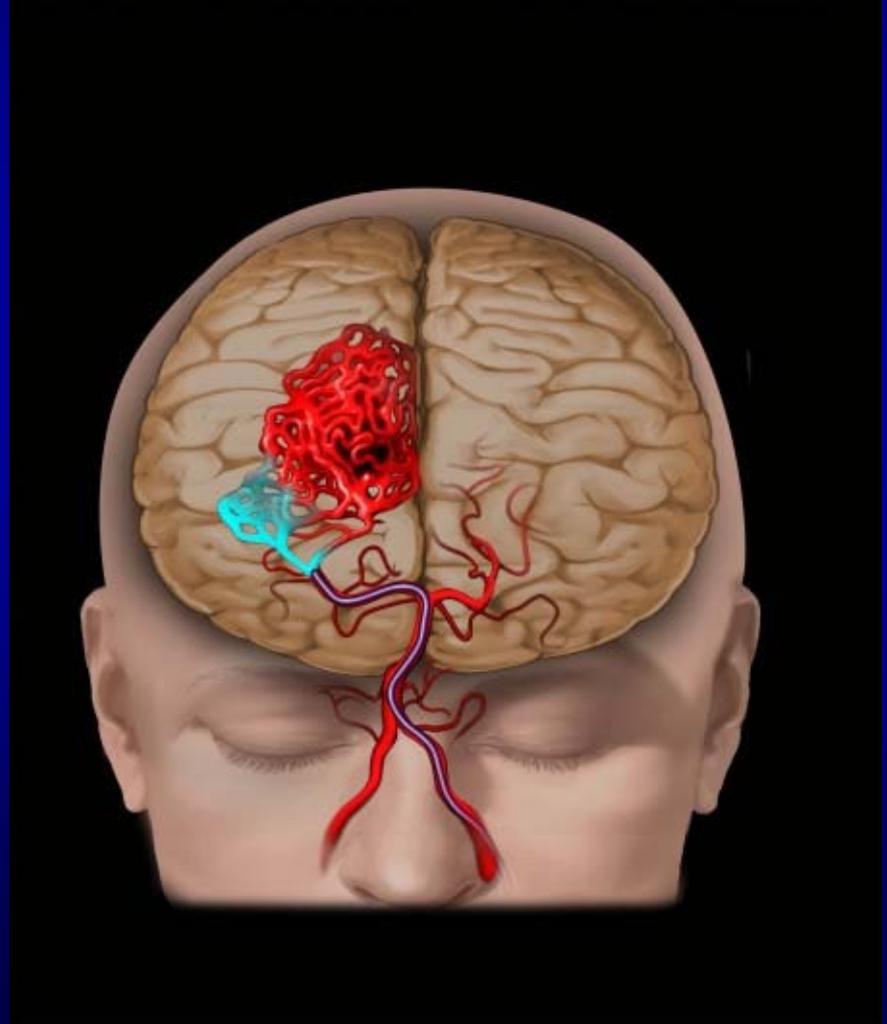


Atrapar el coágulo con un “stent”

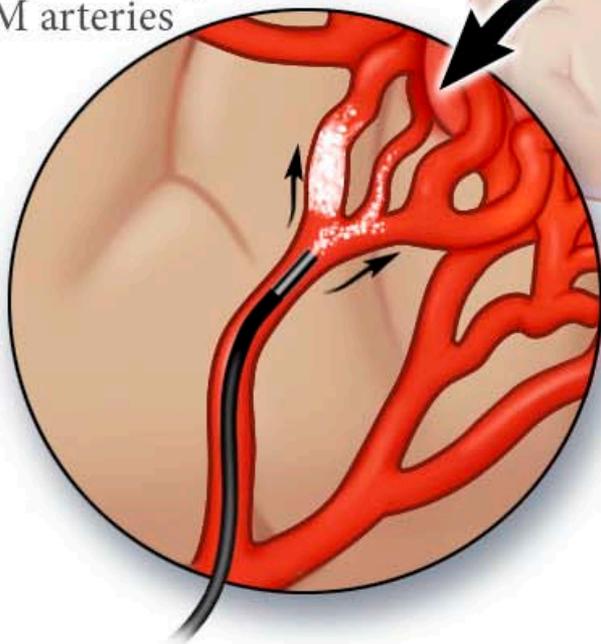


R.G. Nogueira, et als.

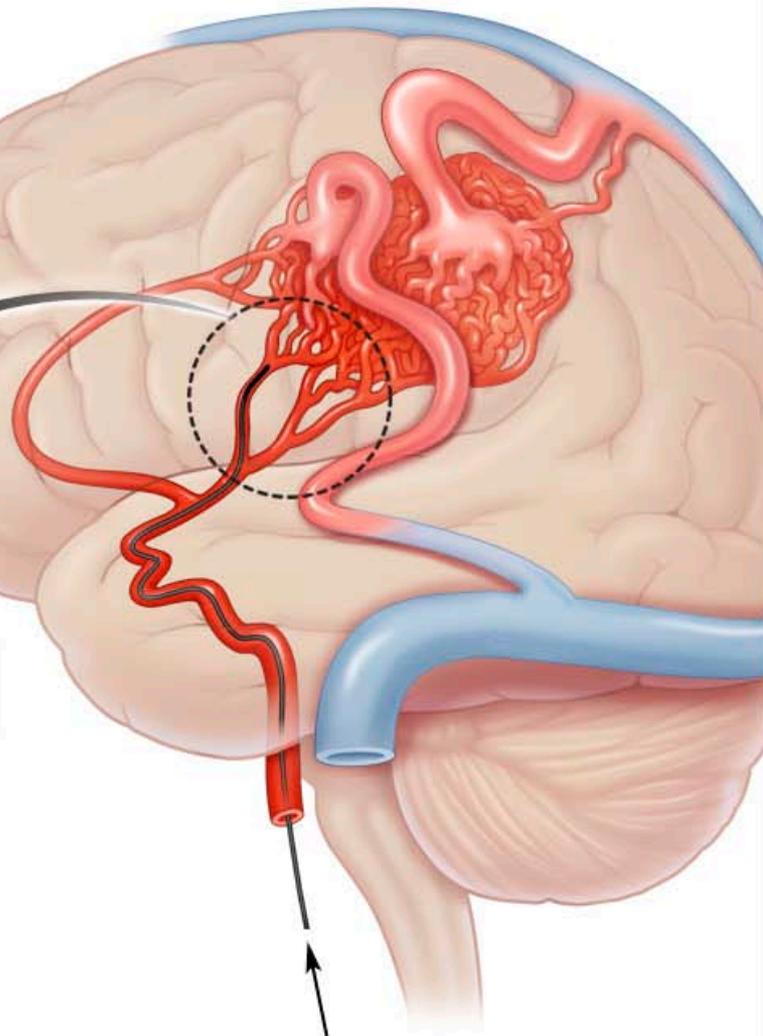
# Boston Scientific VortX Coil



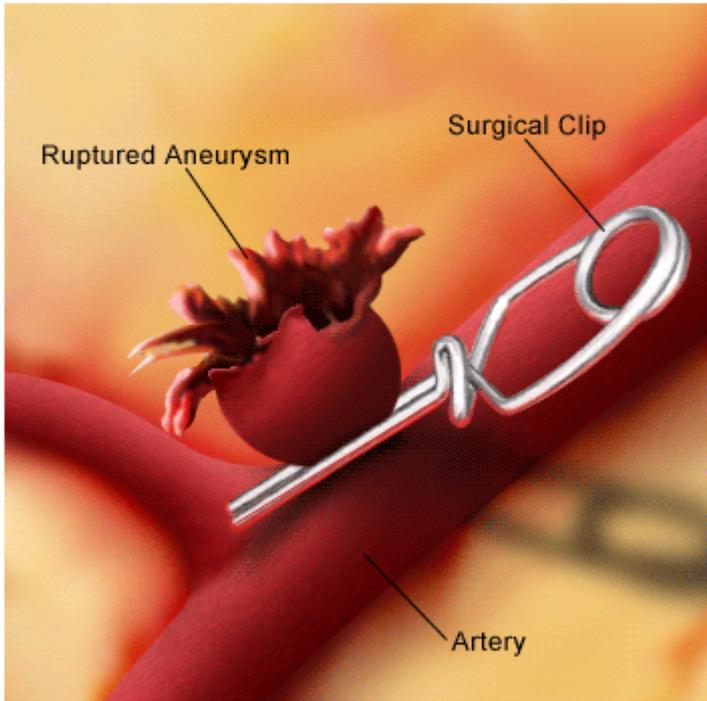
PVA occluding  
AVM arteries



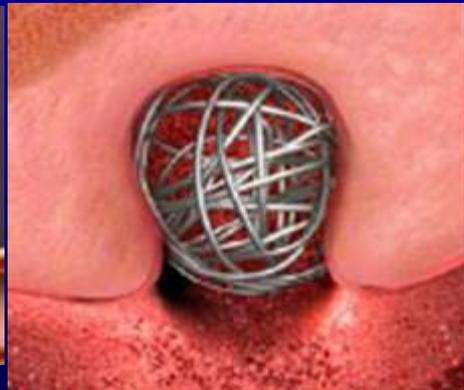
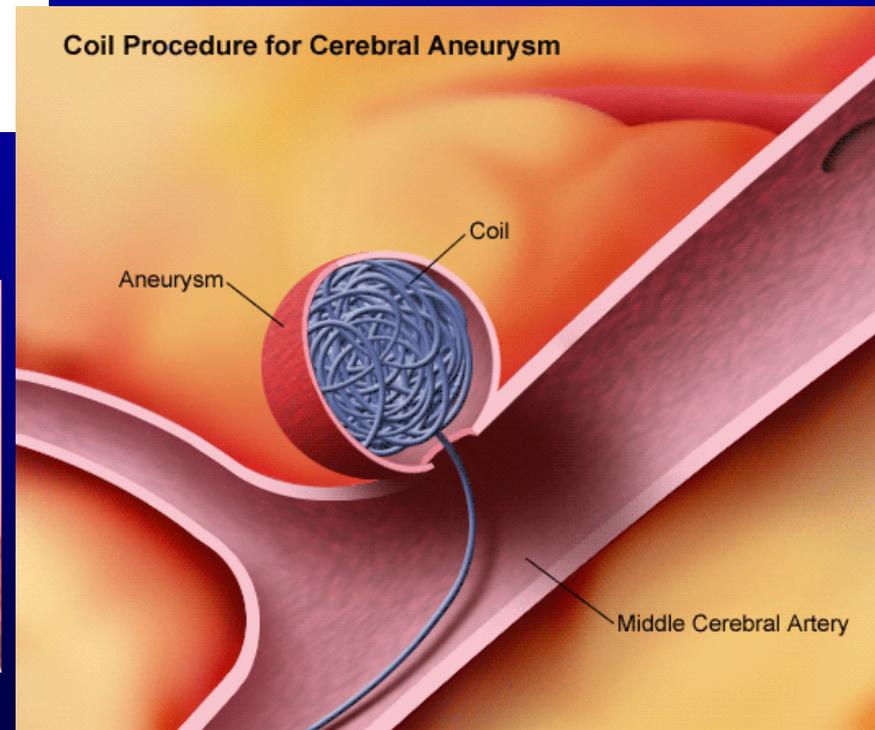
Catheter in  
Carotid Artery  
targeting AVM

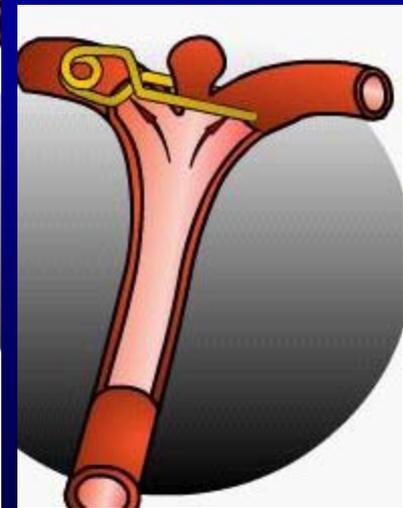
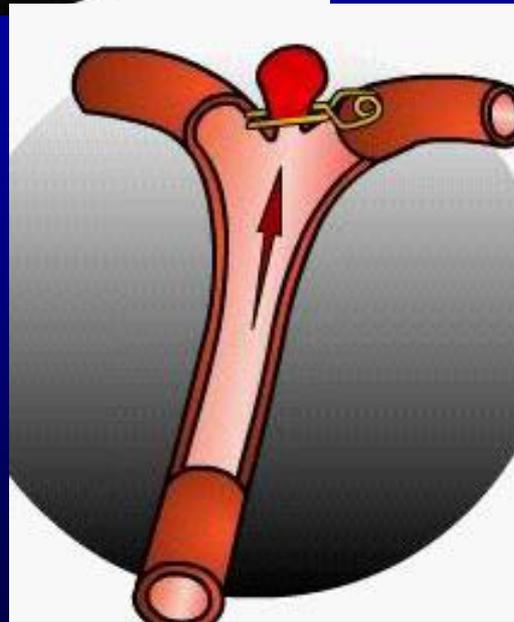
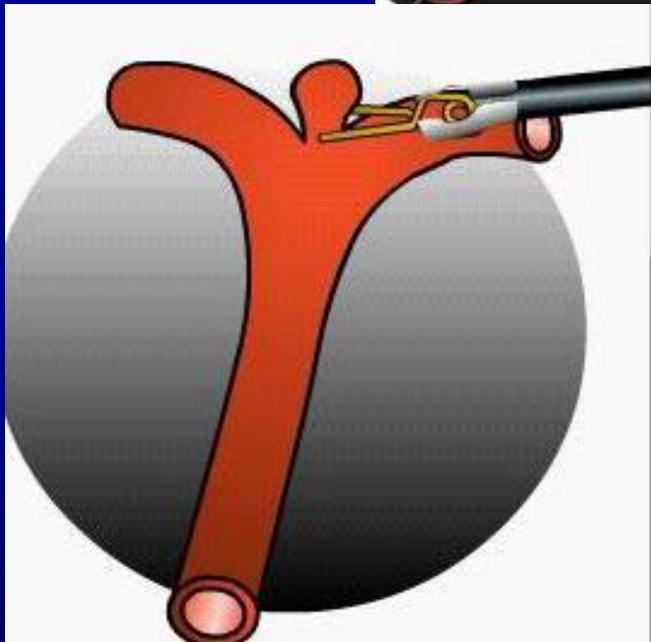
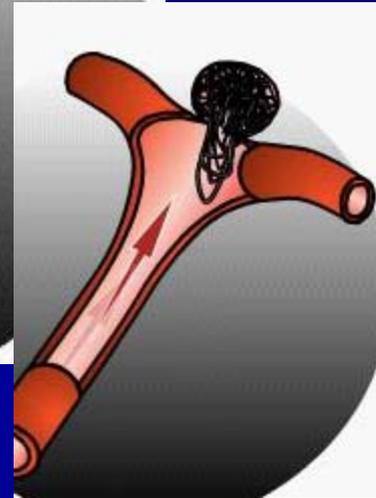
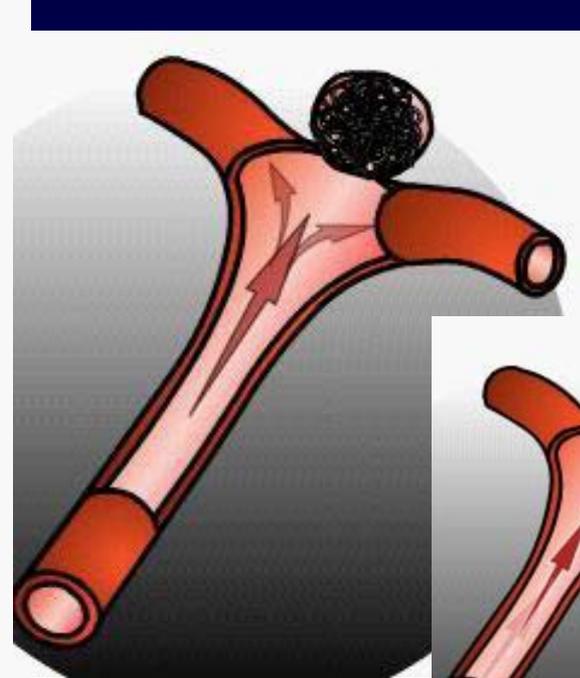
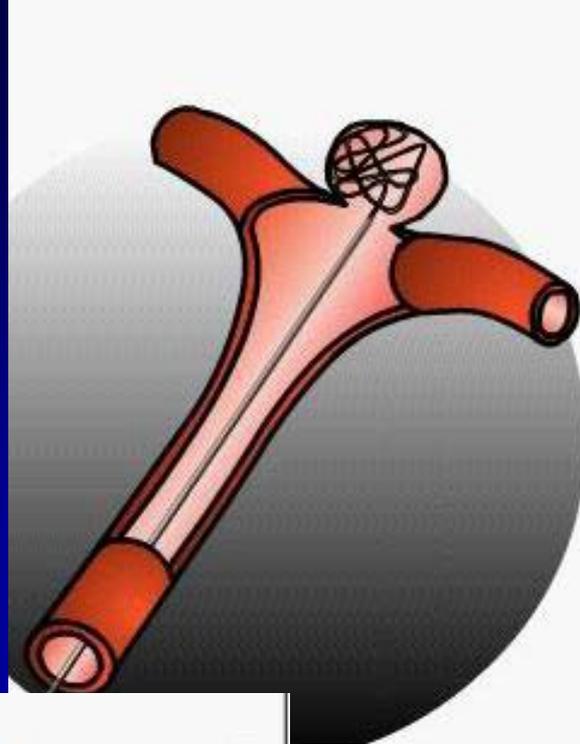
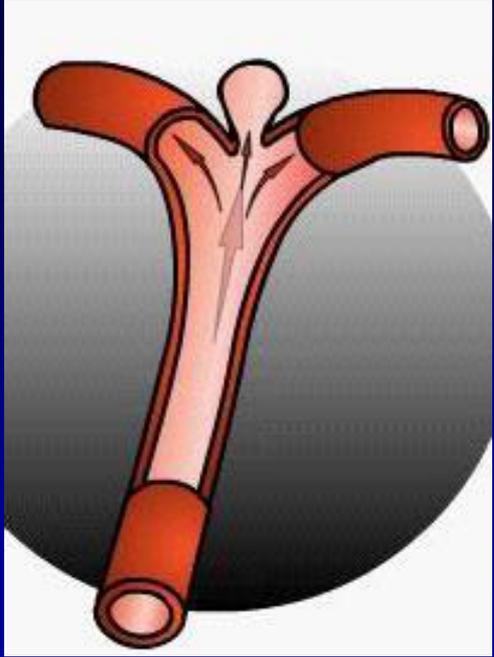


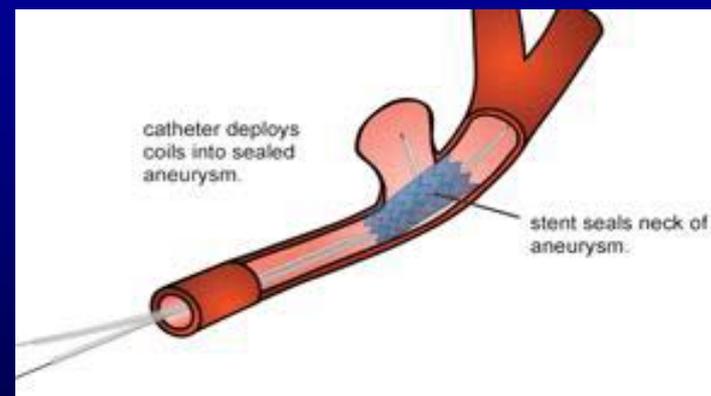
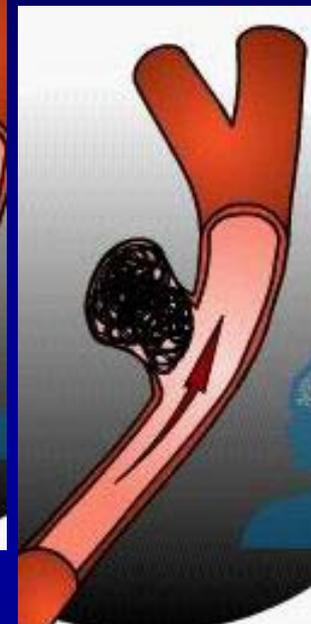
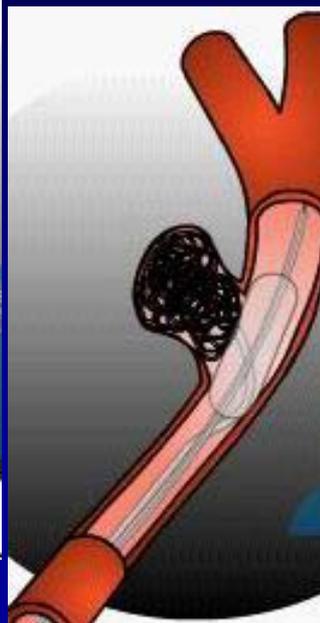
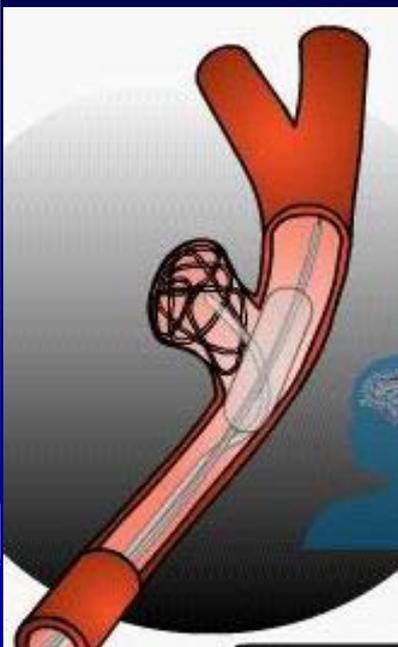
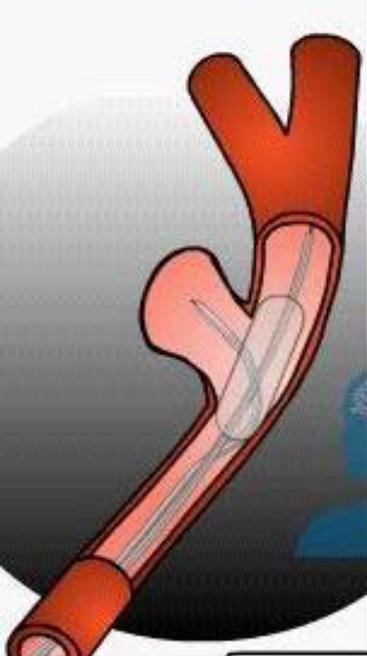
# Clipping Treatment for Cerebral Aneurysm



# Coil Procedure for Cerebral Aneurysm





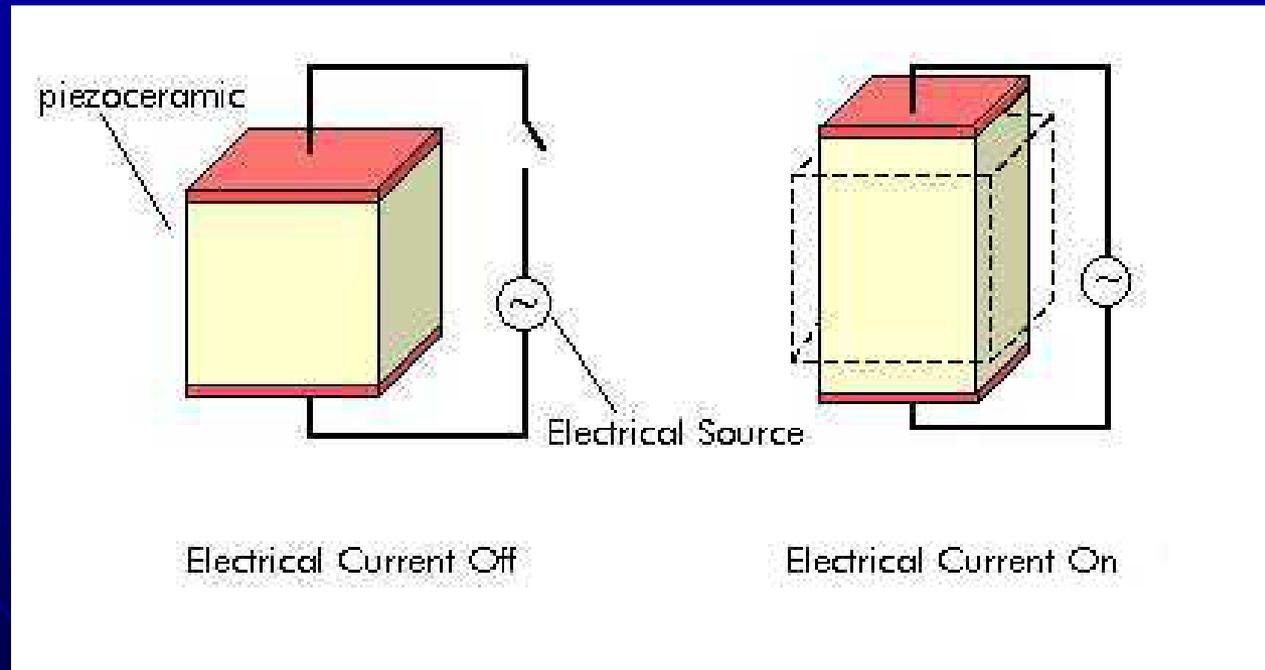


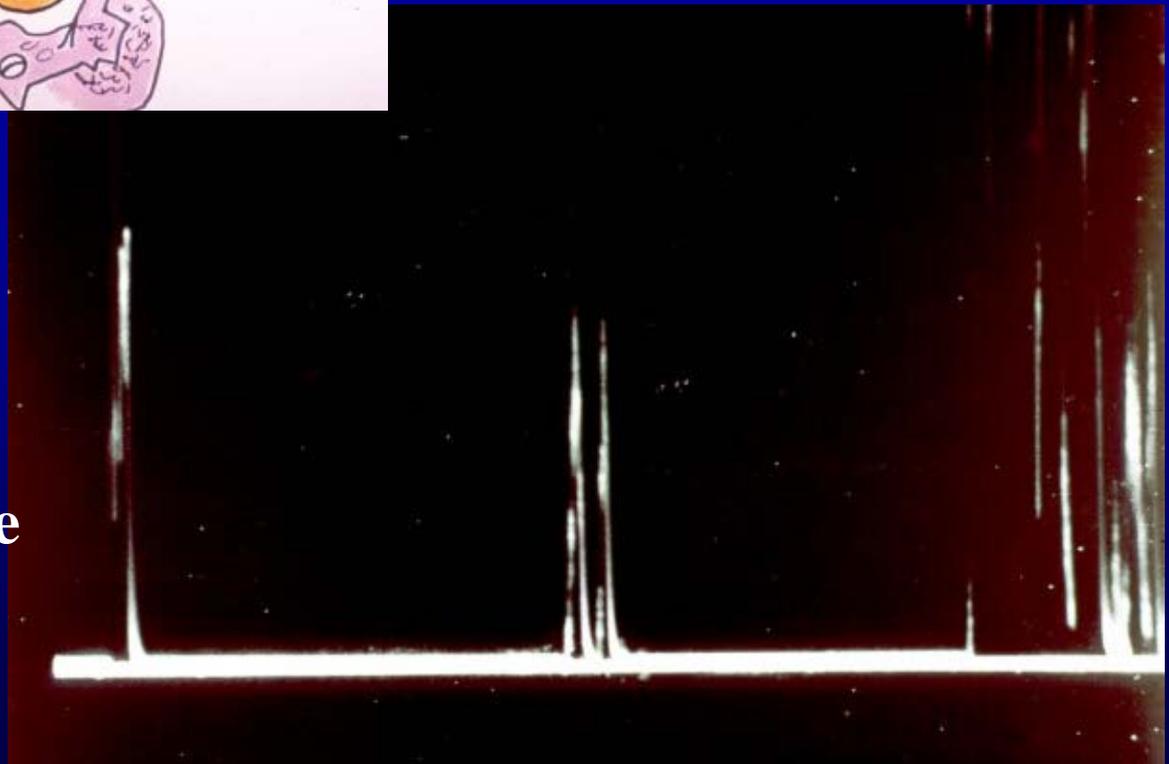
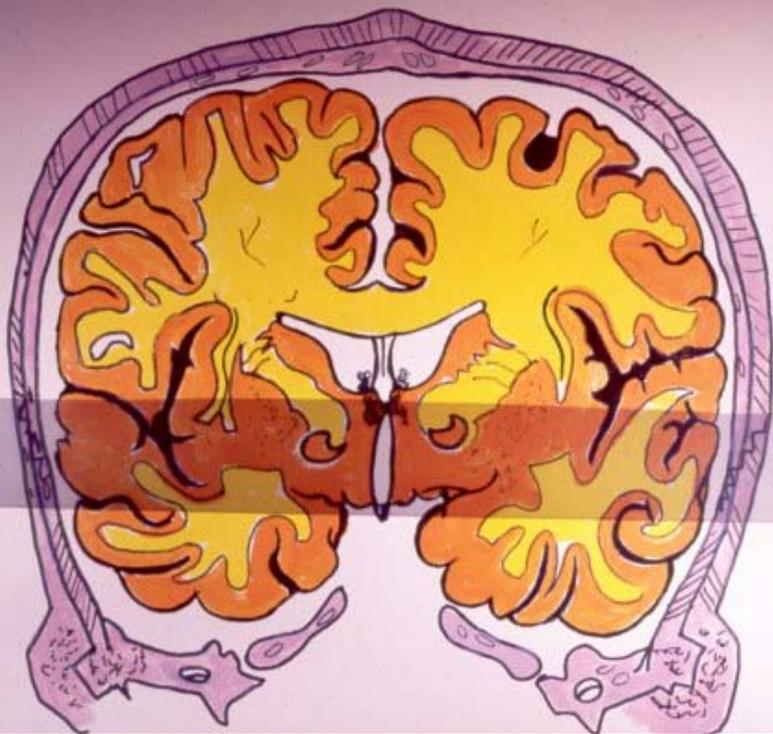
# Ultrasonidos

## Fenómeno piezoeléctrico

Pierre y Jacques Curie  
1880

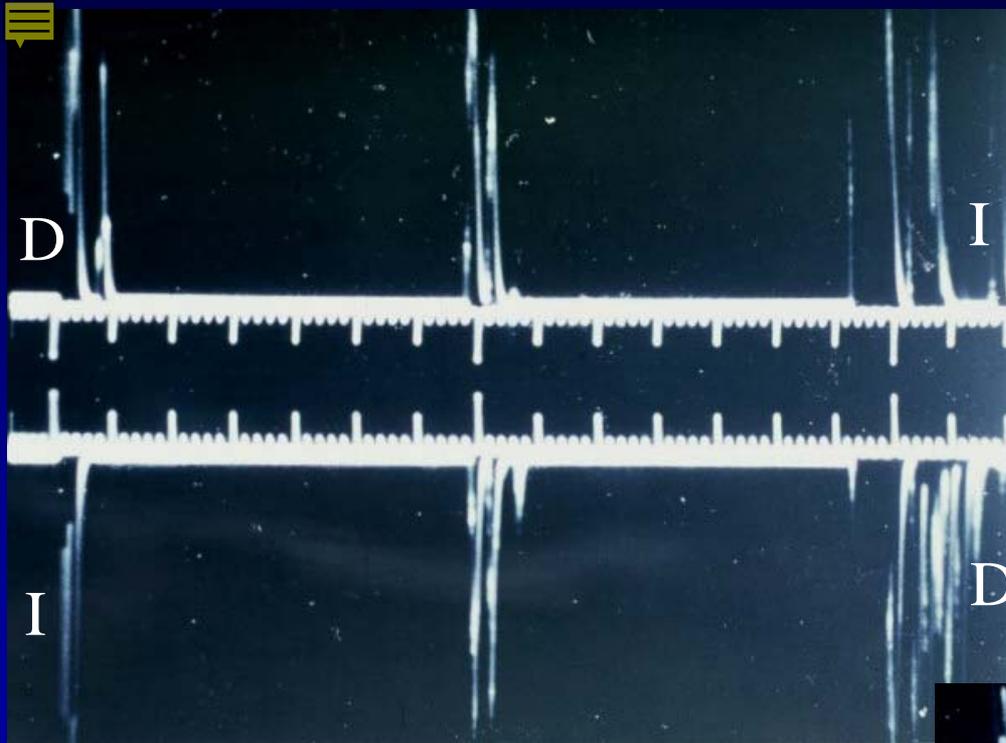
Compresión →  
corriente  
Corriente → altera la  
forma





**Modo - A**

**A-mode Amplitude-mode**



**Modo – A**

Derecha → Izquierda

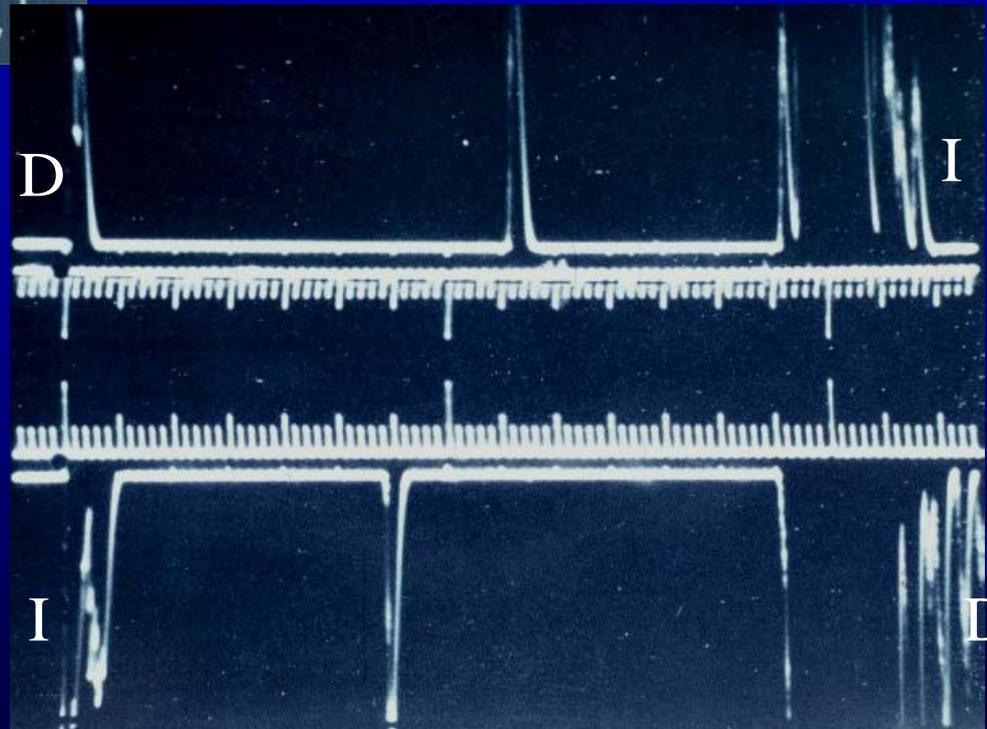
Derecha ← Izquierda

Normal

Desplazamiento de la línea media (III ventrículo) →

1972

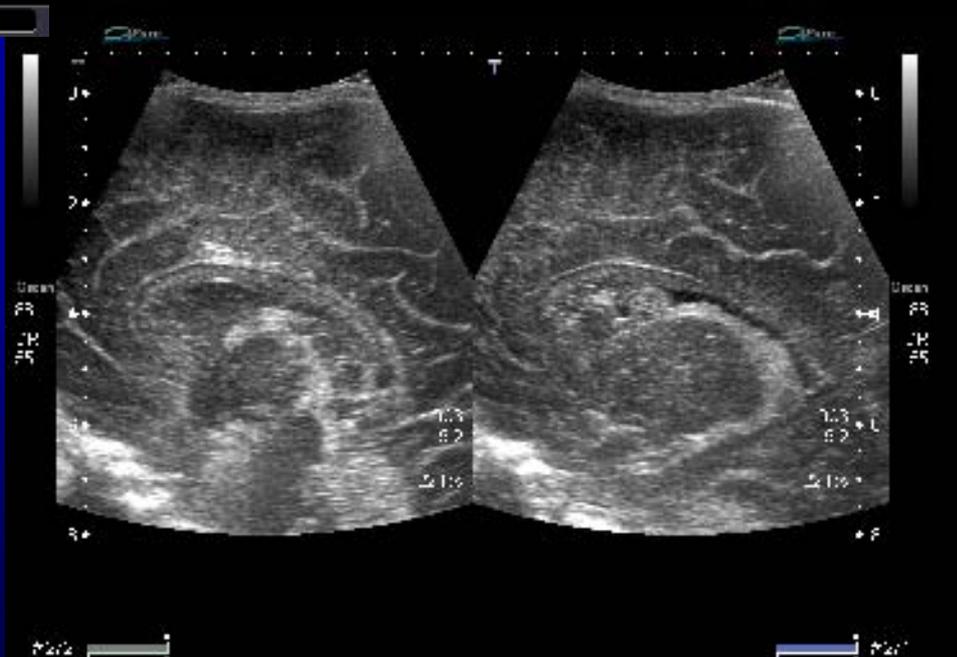
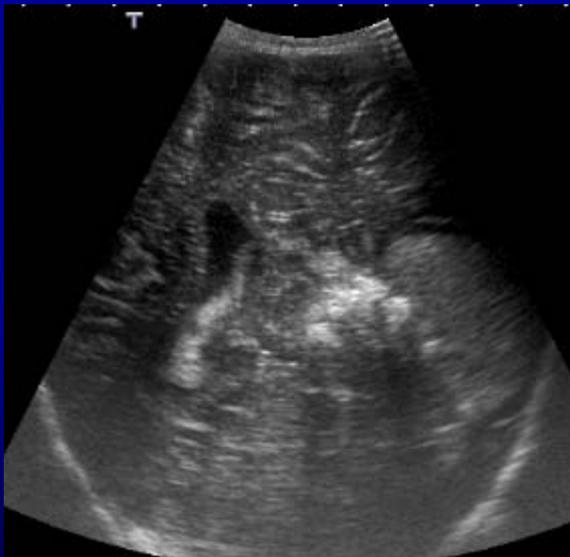
(herniación de derecha a izquierda)

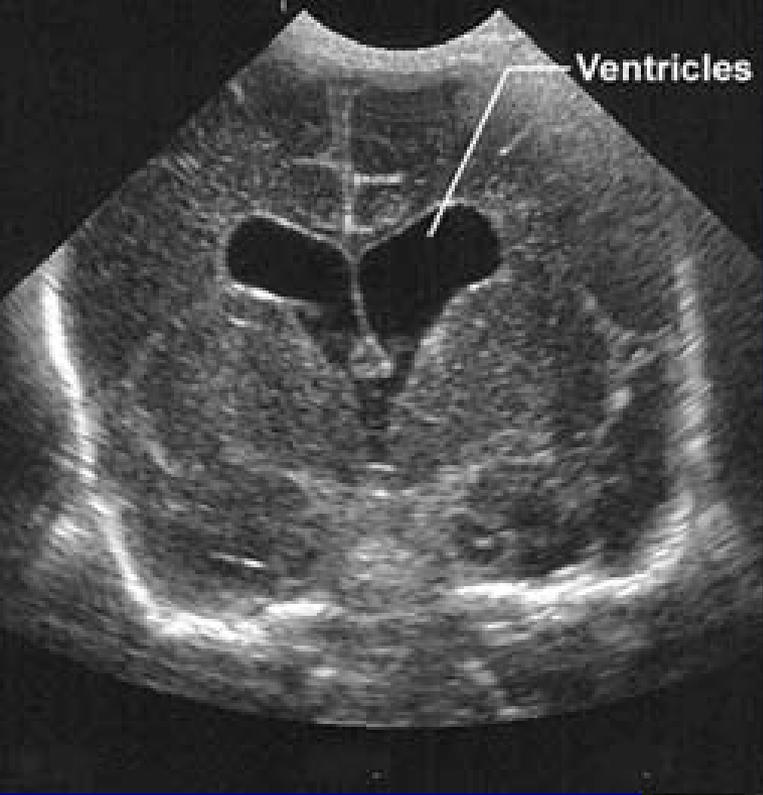




**Modo – B (brillo)**

**B-mode brightness**



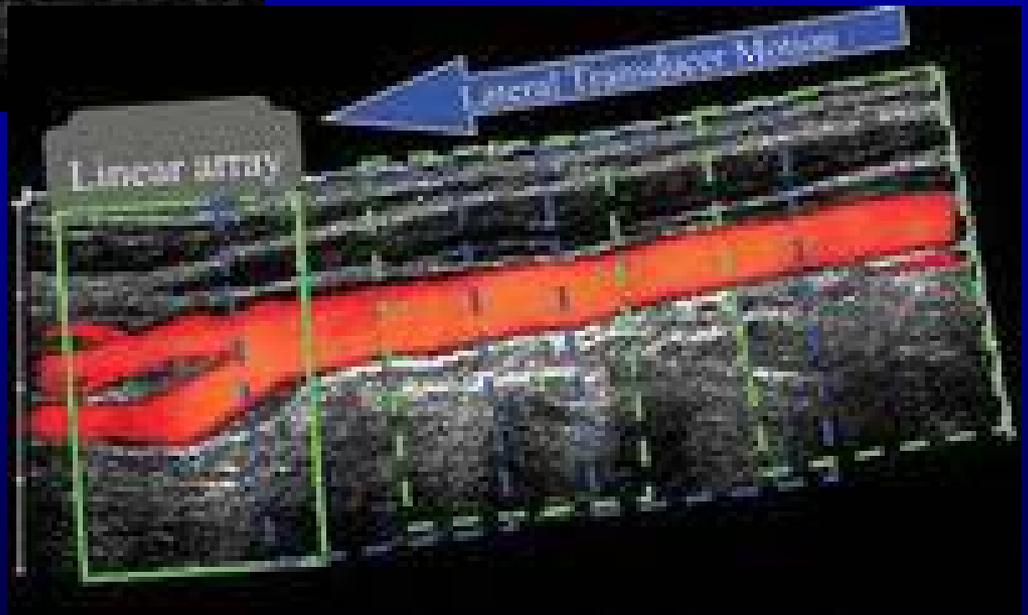




Hydrocephalia



Doppler





Día 42



8 semanas → 3cm  
Pesa 1 gramo



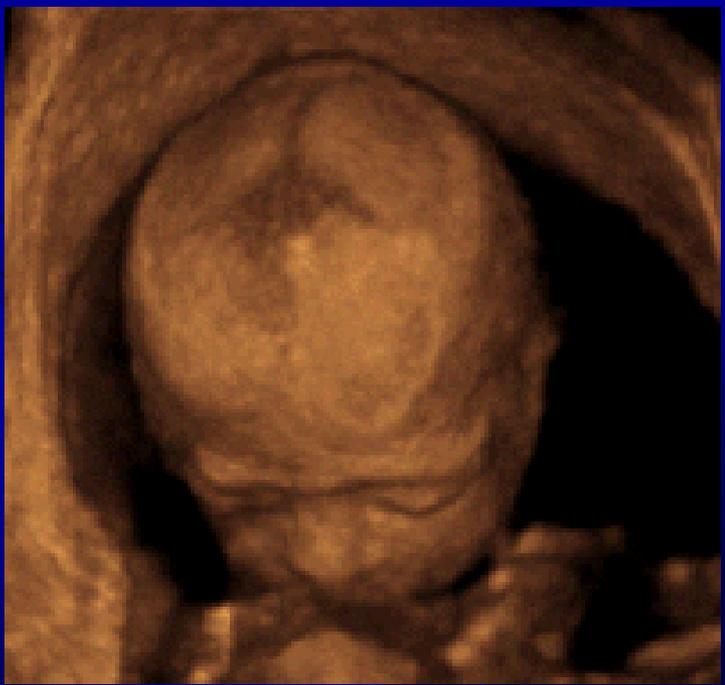
Fetus at 9 weeks



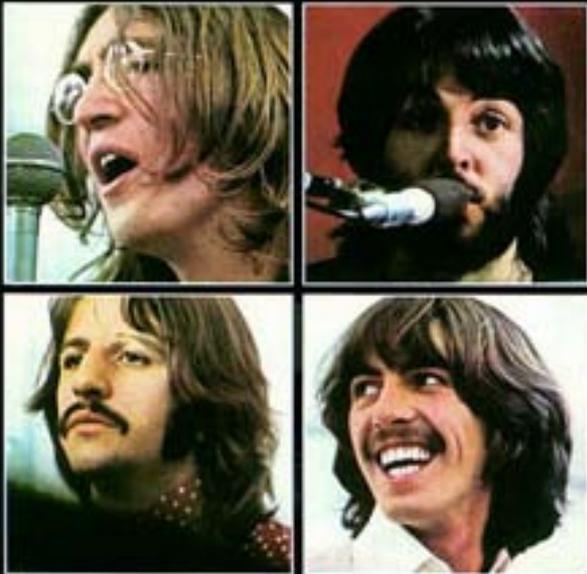
28 - WEEK FETAL FINGERS



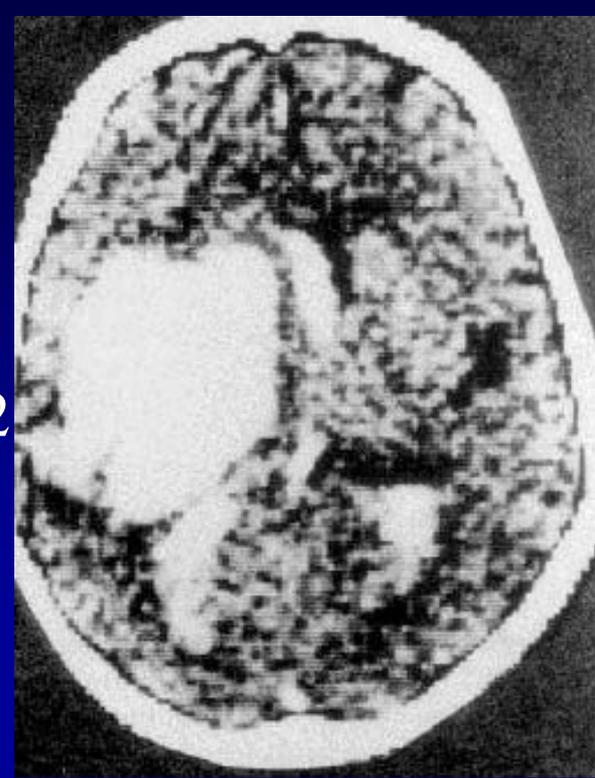
FETAL FACE



LET IT BE



1972



Tomografía Axial Computarizada **TAC**

**Godfrey Newbold Hounsfield**

**EMI** scanner 1971

Premio Nobel 1979



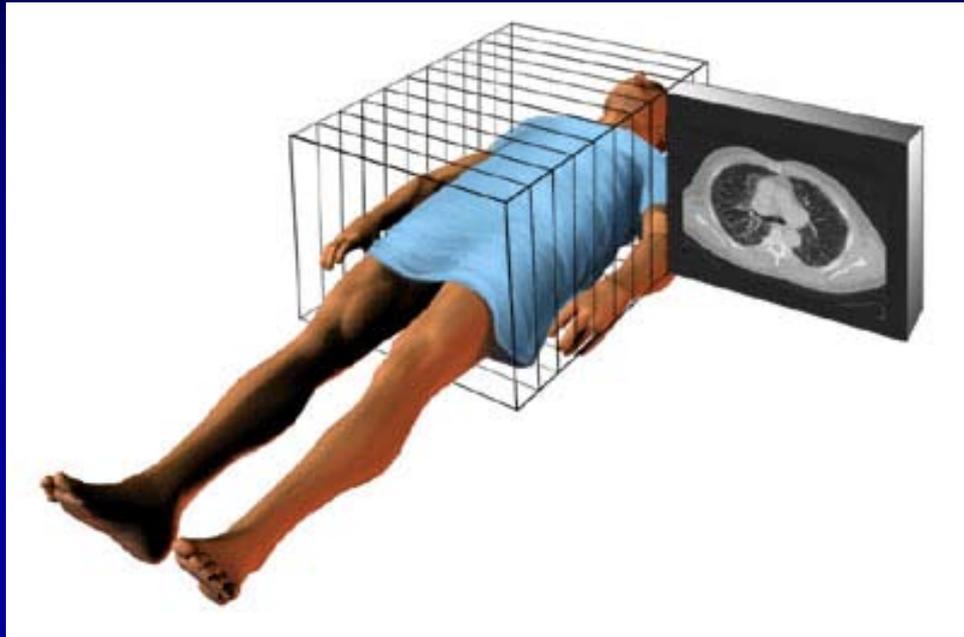
# Atenuación de los rayos X

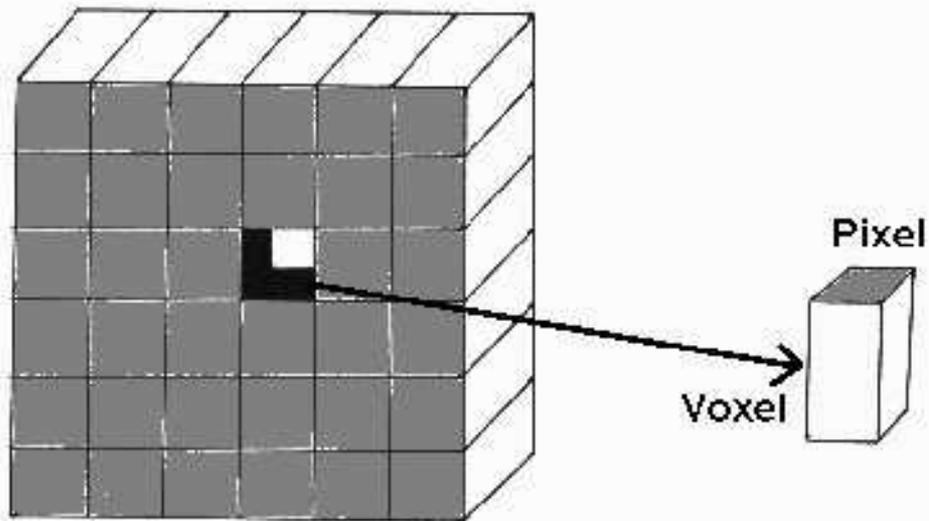
## Haz de rayos muy colimado (fino)

“Ordenadores”

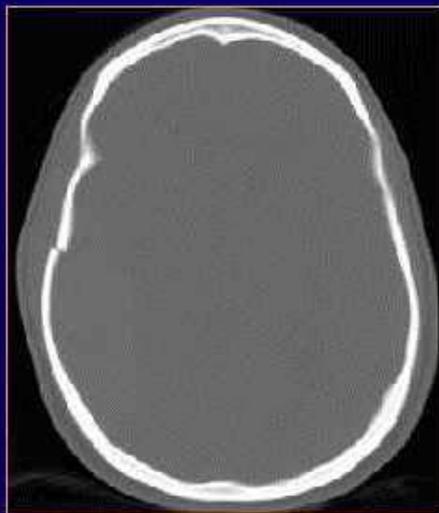
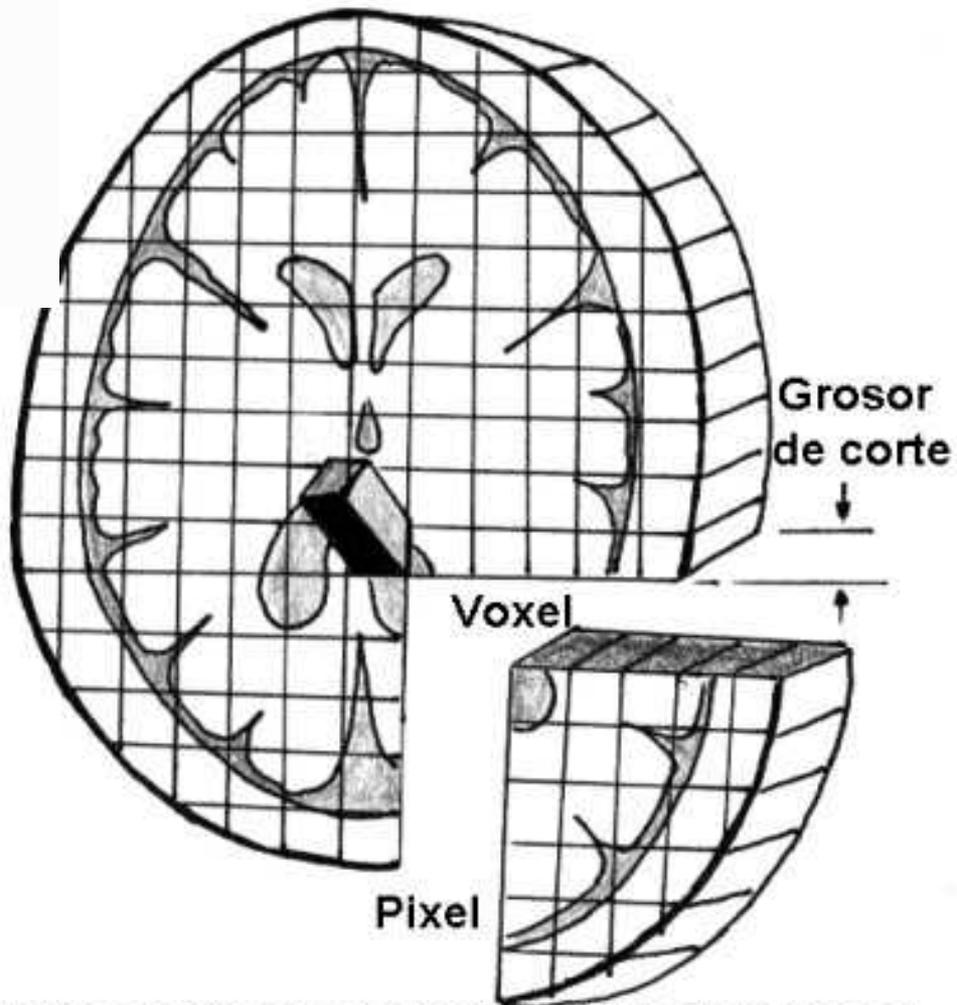


Escala de grises  $\rightarrow$  Unidades Hounsfield  
Agua = 0



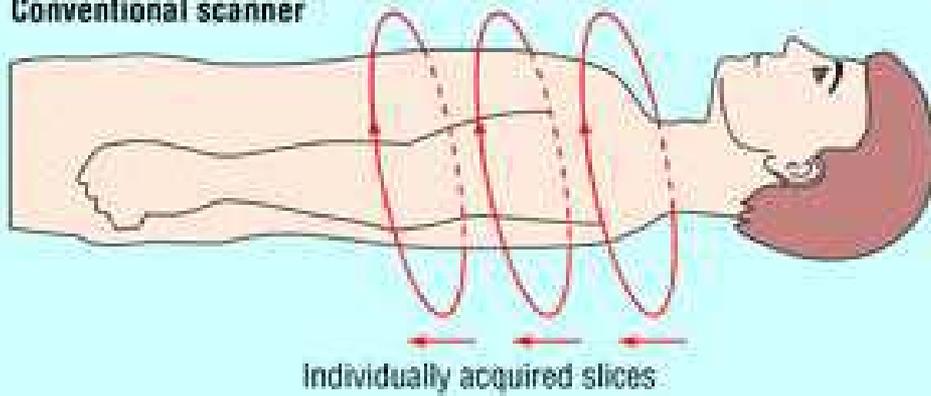


Matriz de la imagen

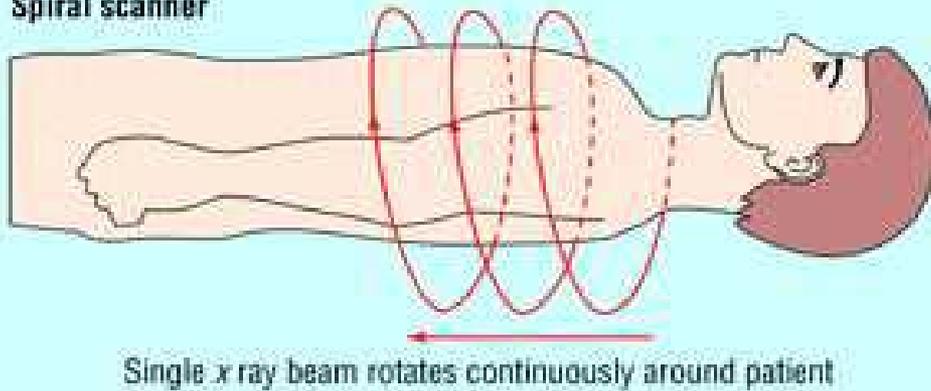


Matriz: el número de pixel que forman la imagen.  
 Pixel: representación en plano del volumen: Voxel

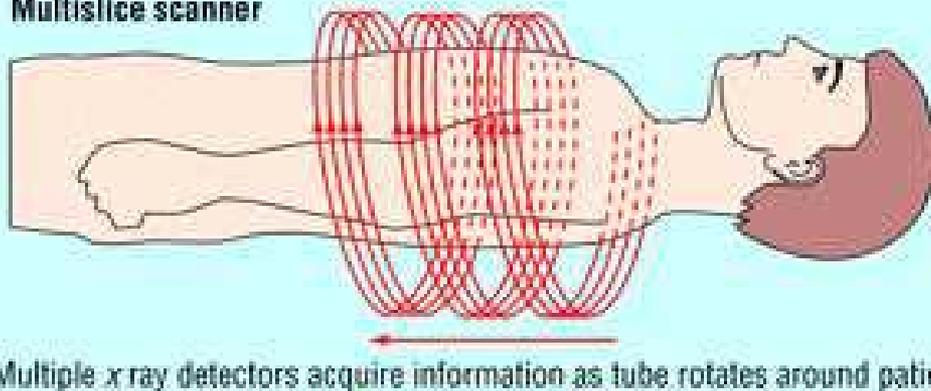
**Conventional scanner**



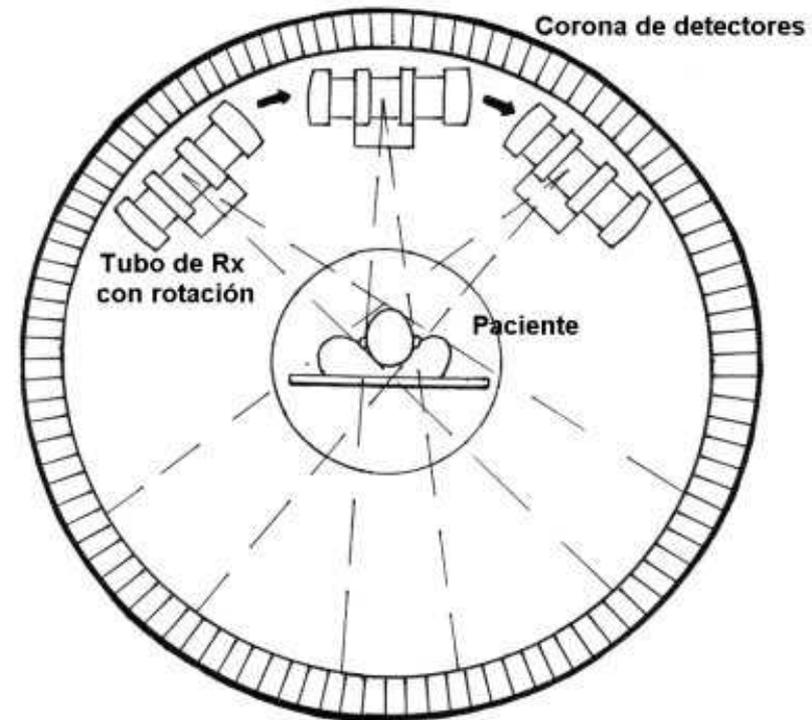
**Spiral scanner**



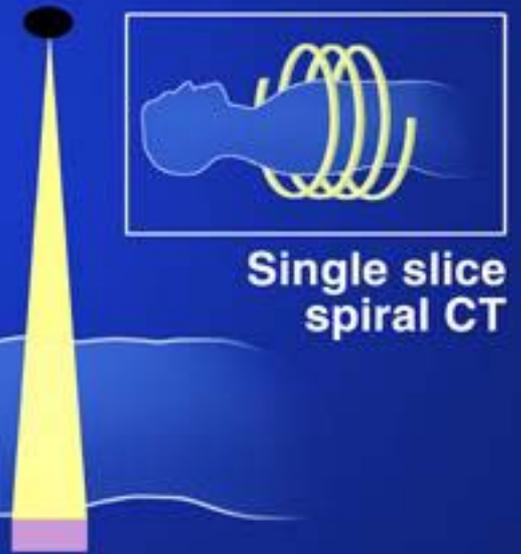
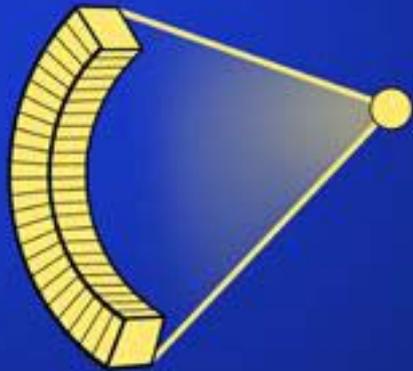
**Multislice scanner**



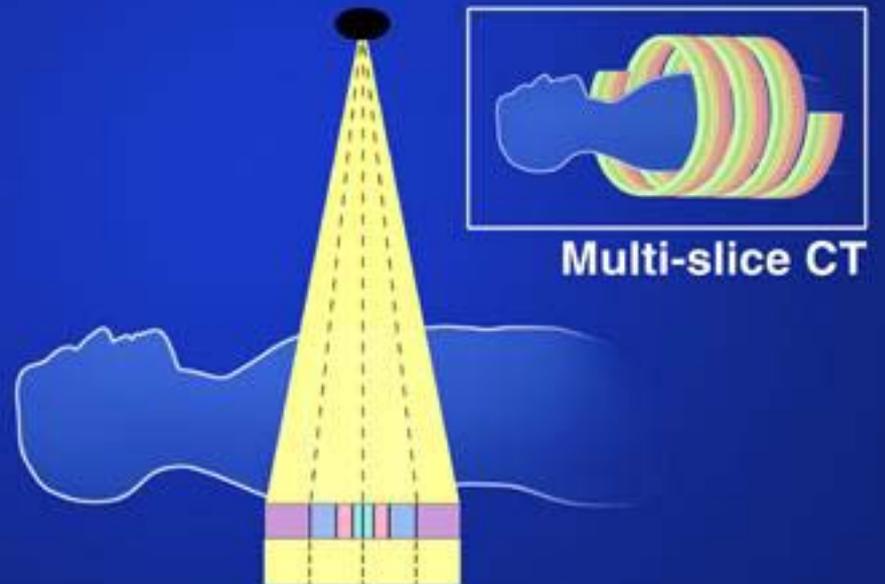
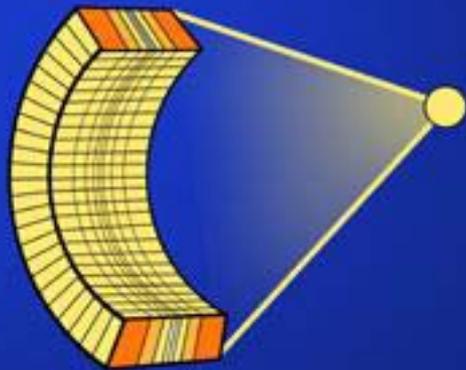
# TC TAC “ESCANER”



**SDCT**

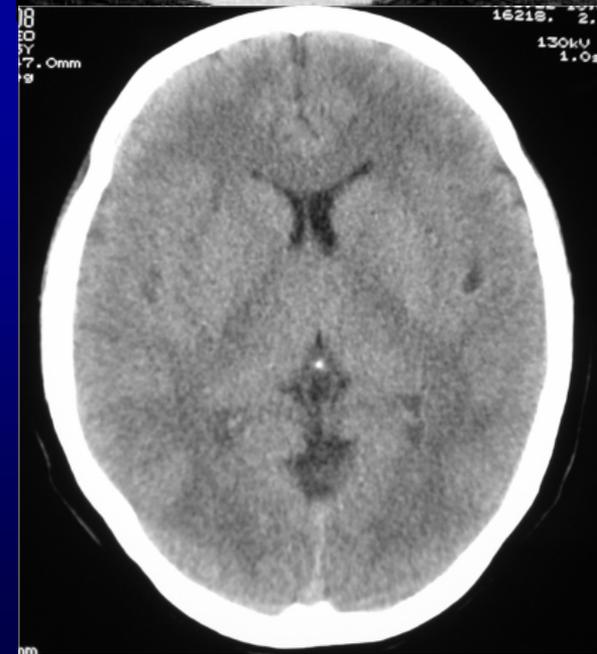
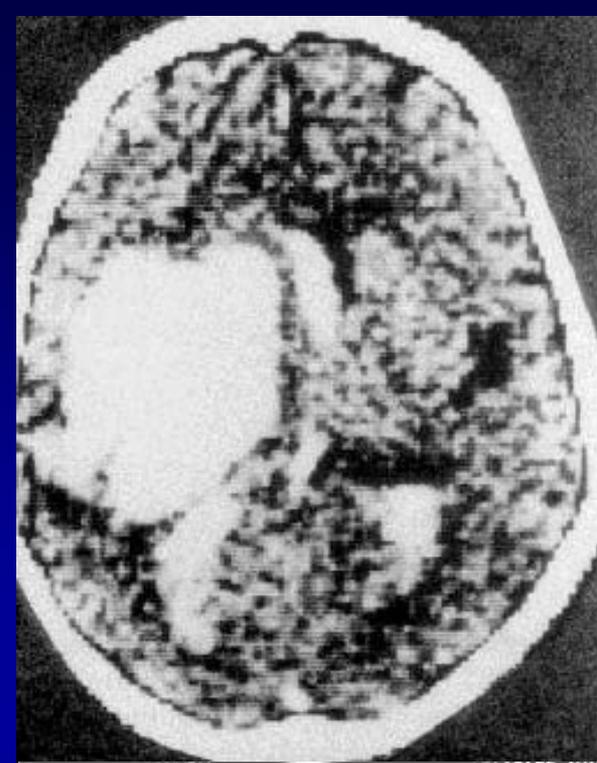
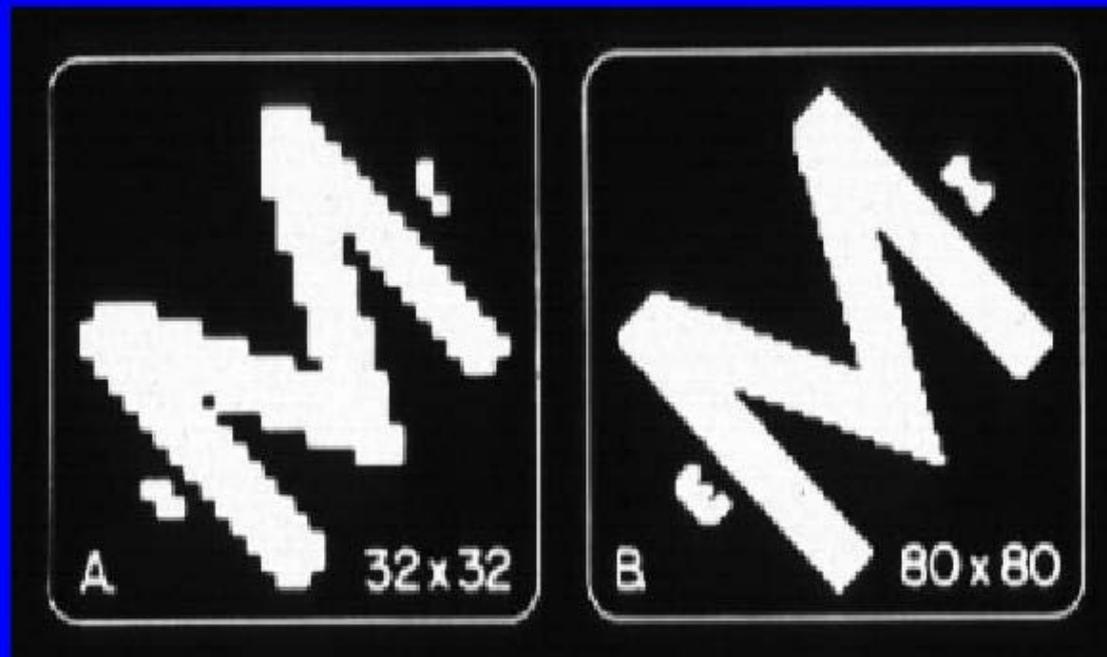


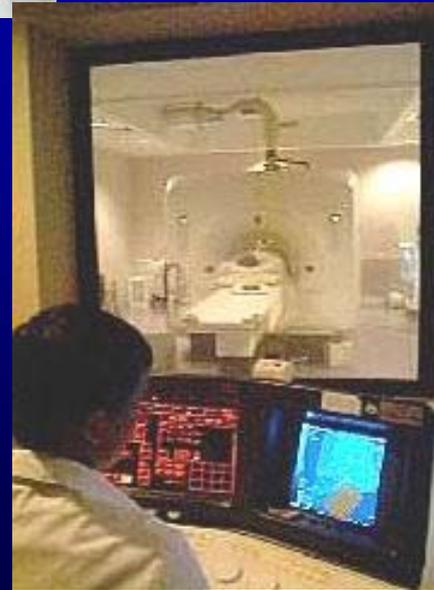
**MDCT**

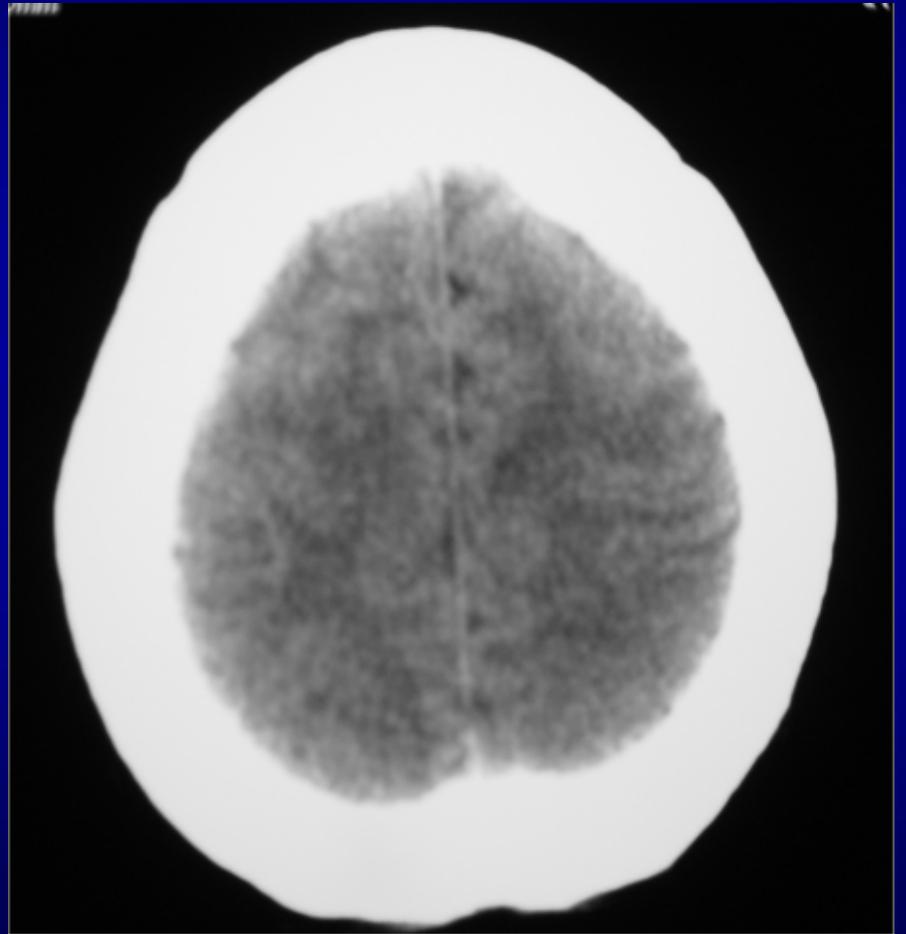


# Reconstrucción de Imagen en TC

## CT: image reconstruction



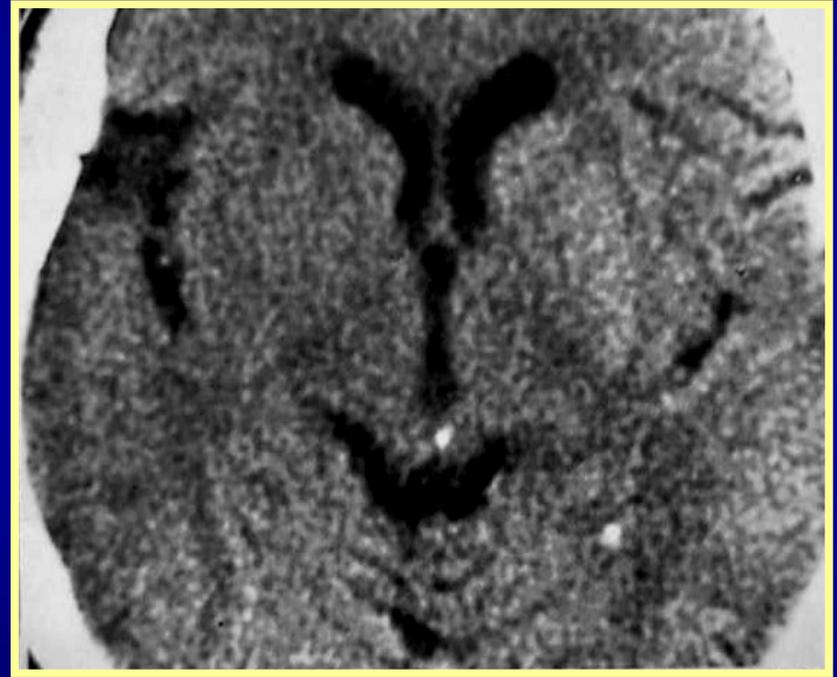
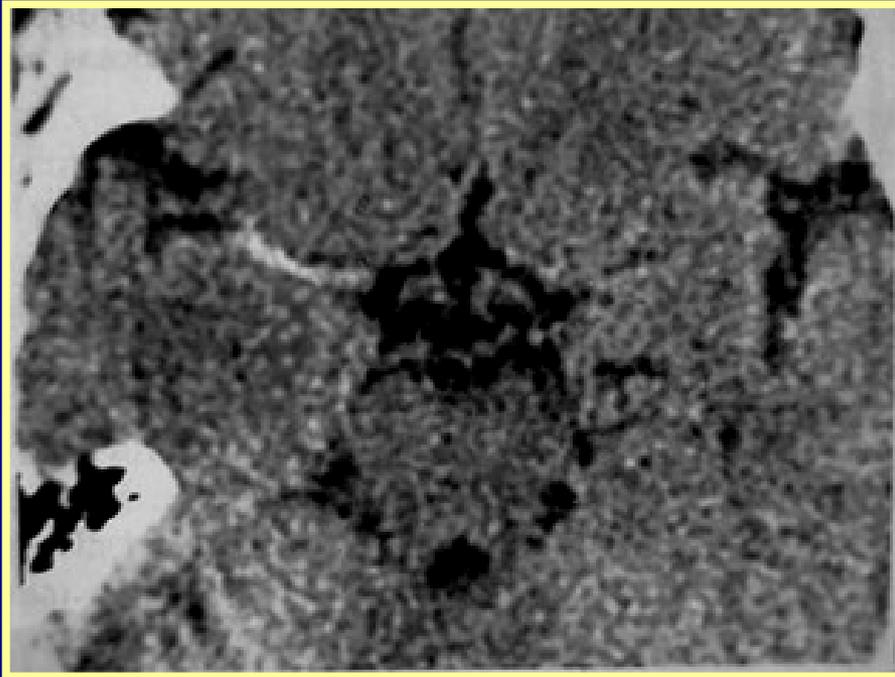




## Densidades

→ Hiperdensidad

→ Hipodensidad

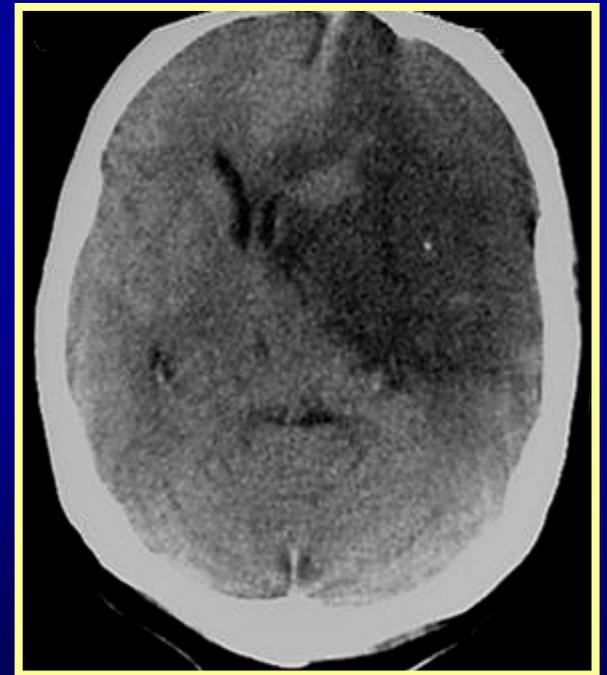


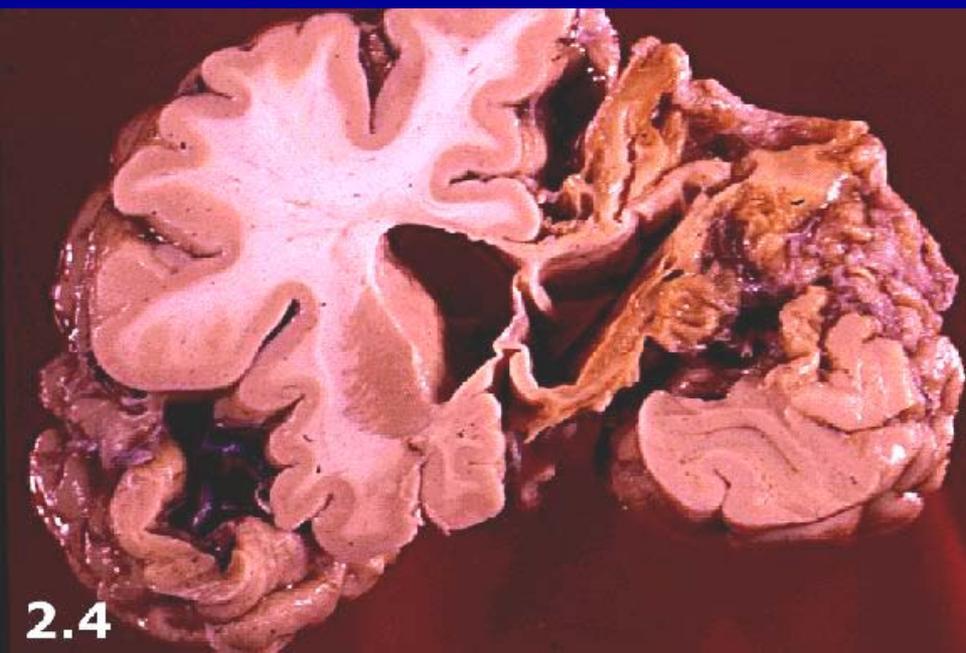
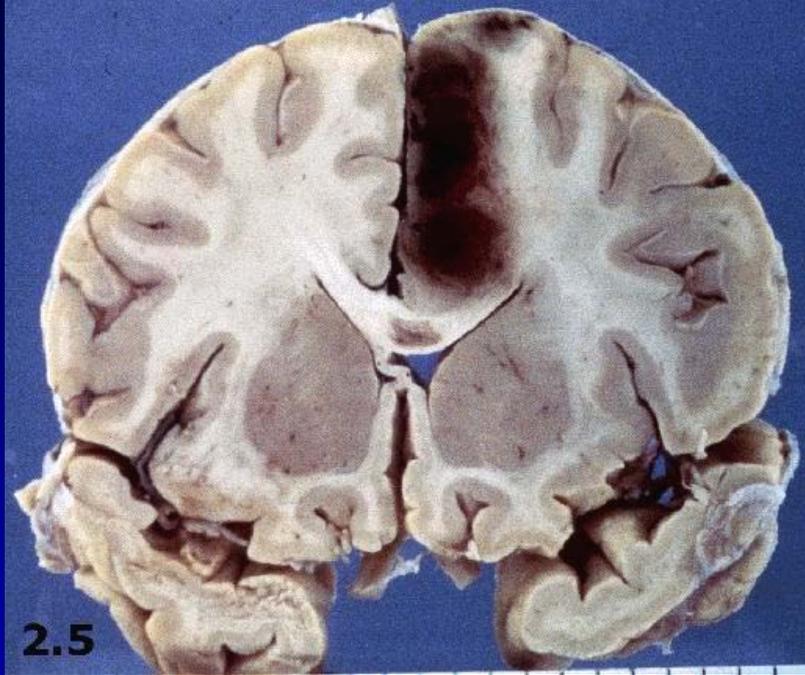
Efecto masa → edema

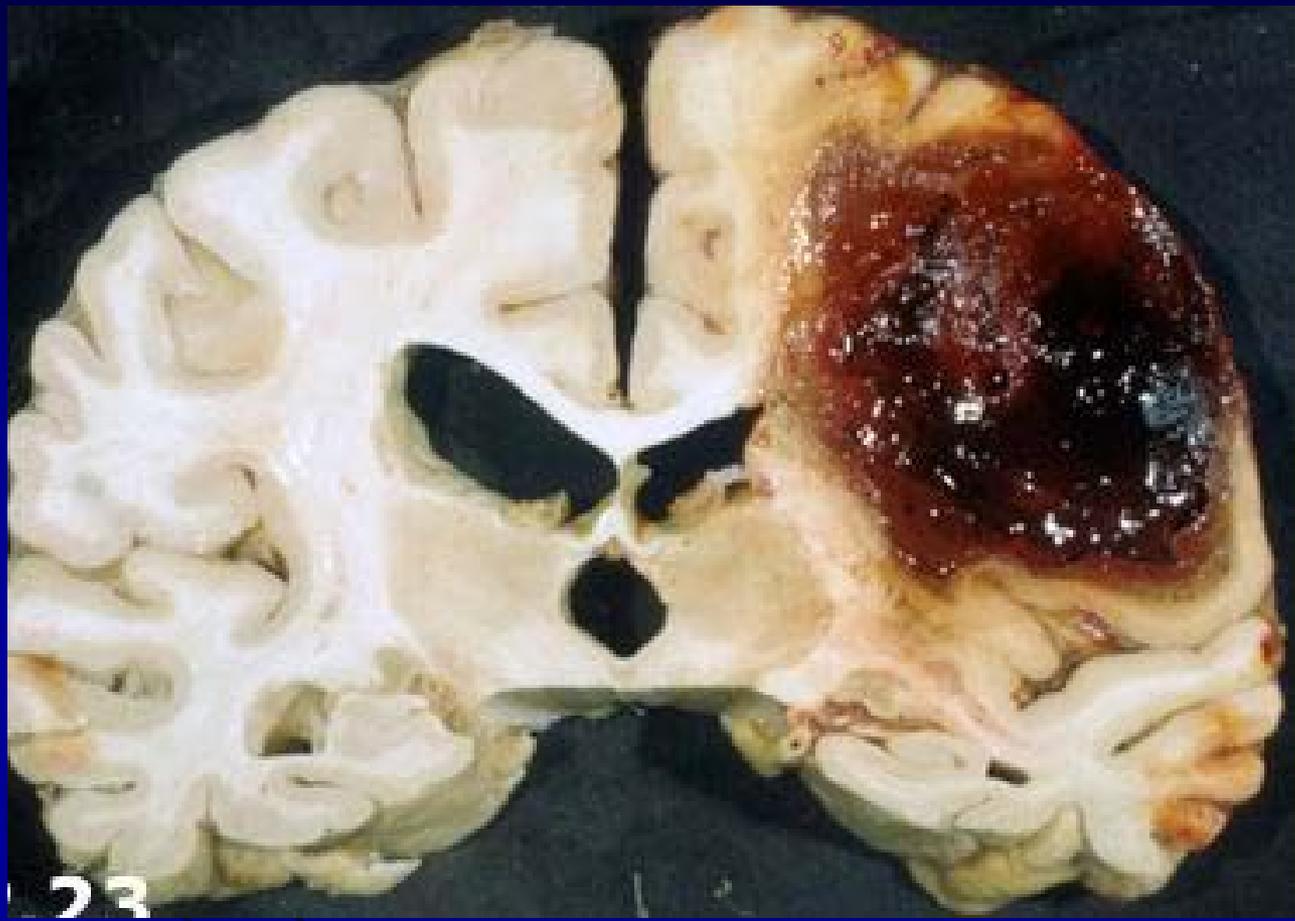
-Borramiento de surcos

-Colapsos ventriculares

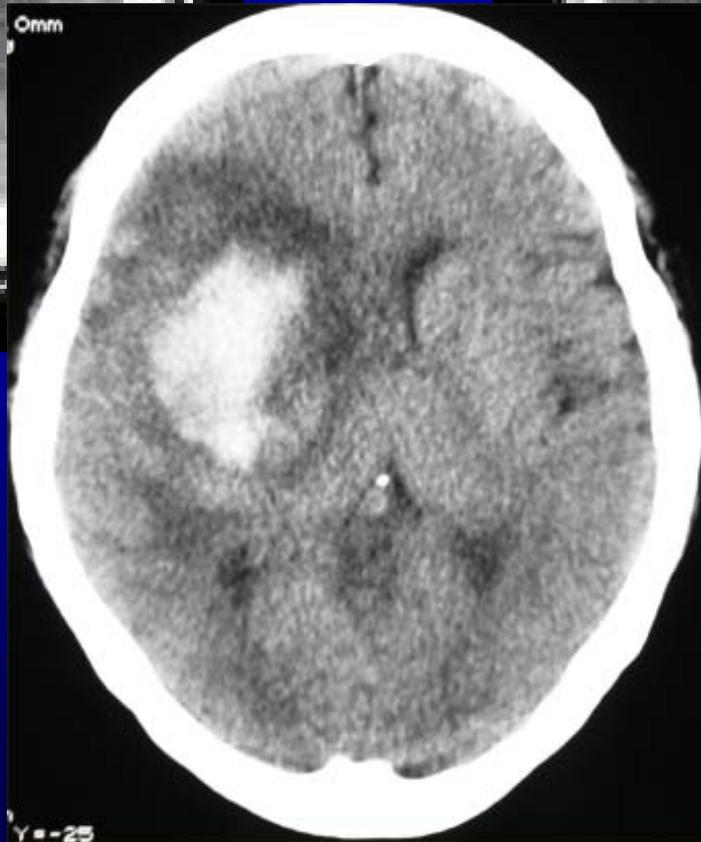
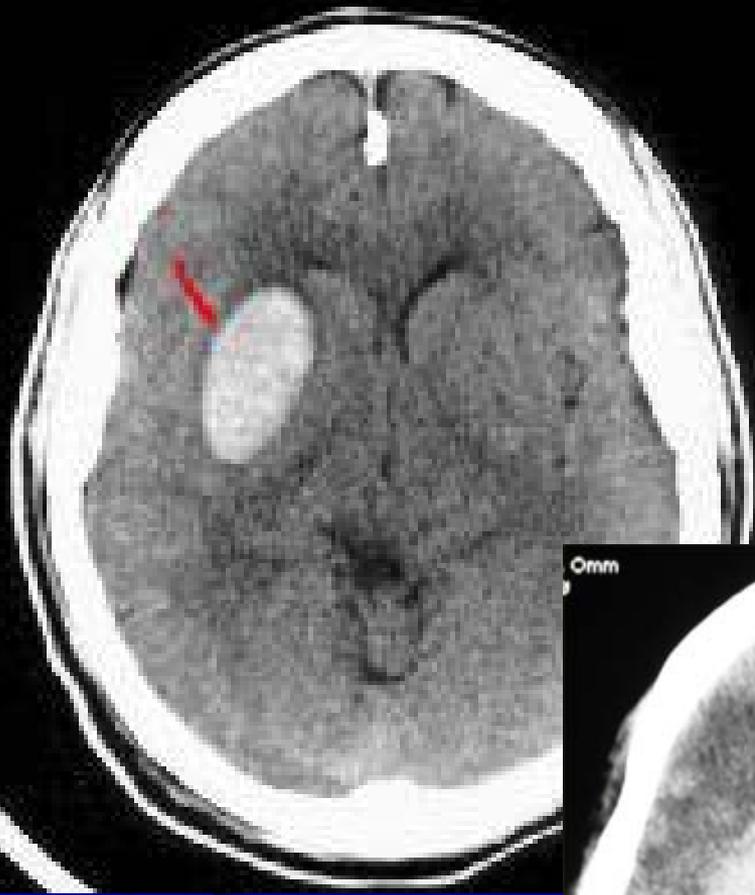
-Herniaciones subfalcianas y transtentoriales

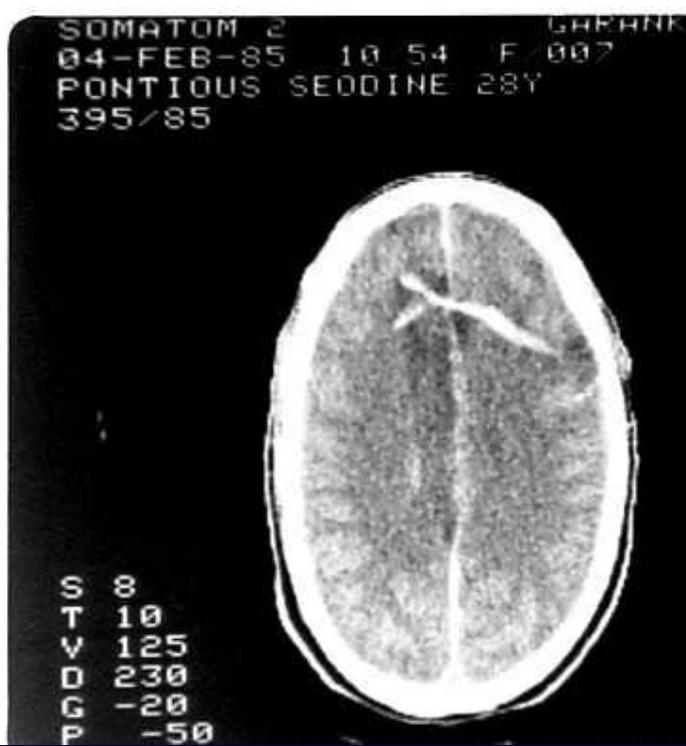
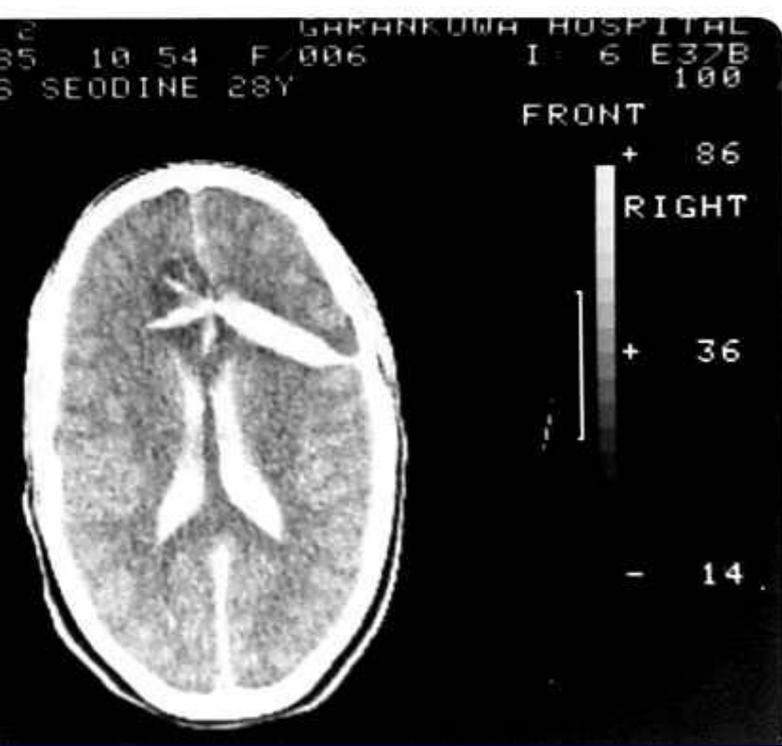
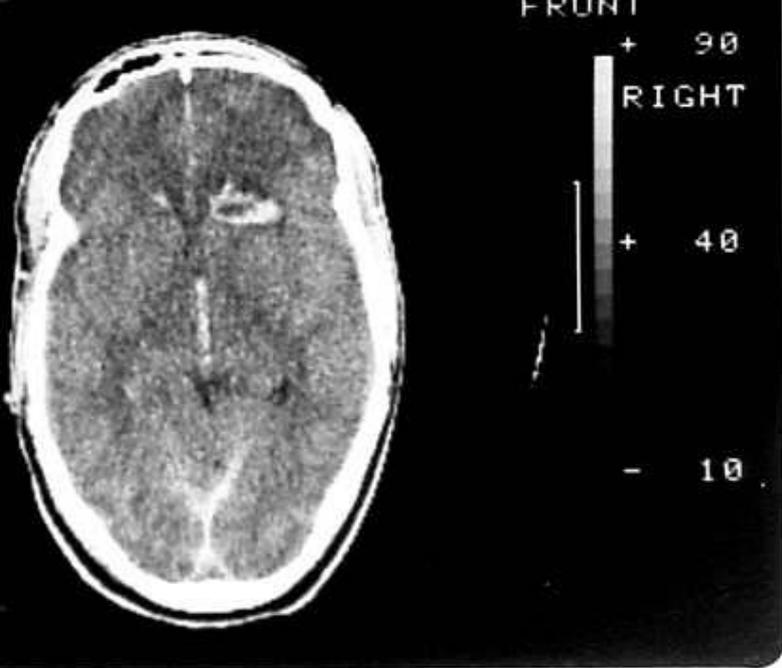


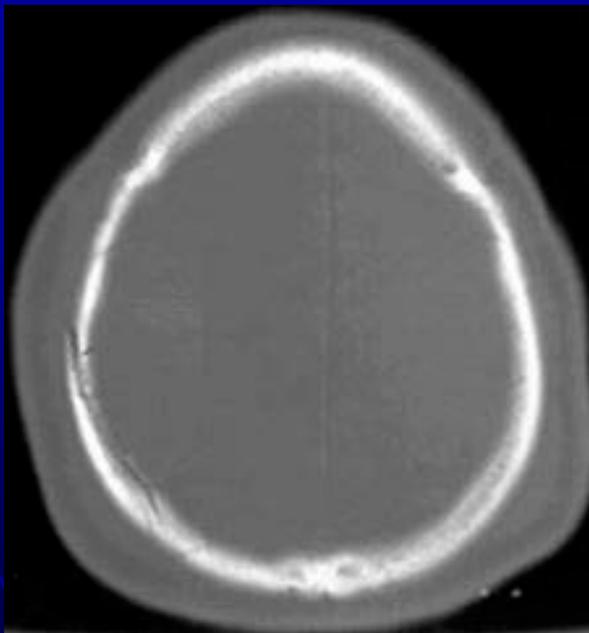
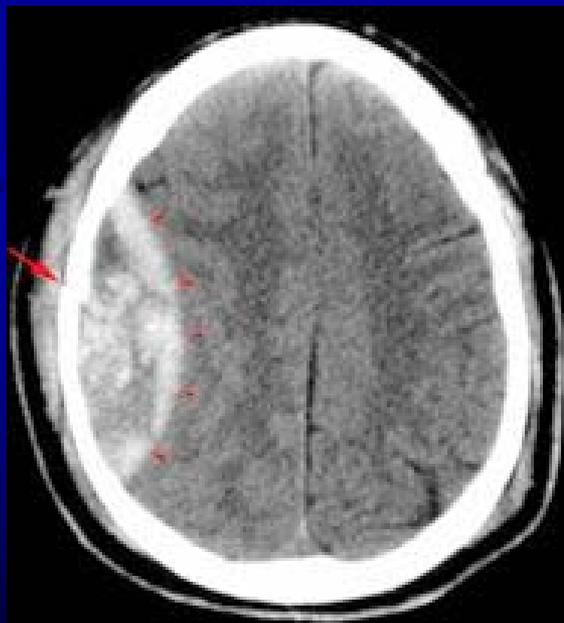
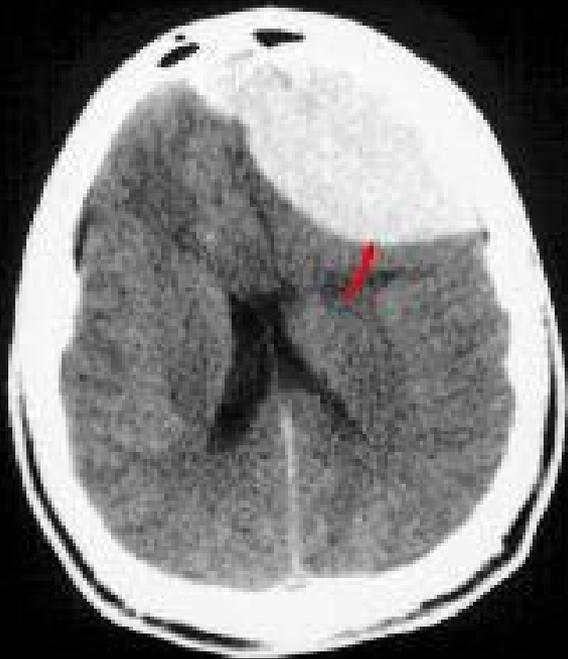




23

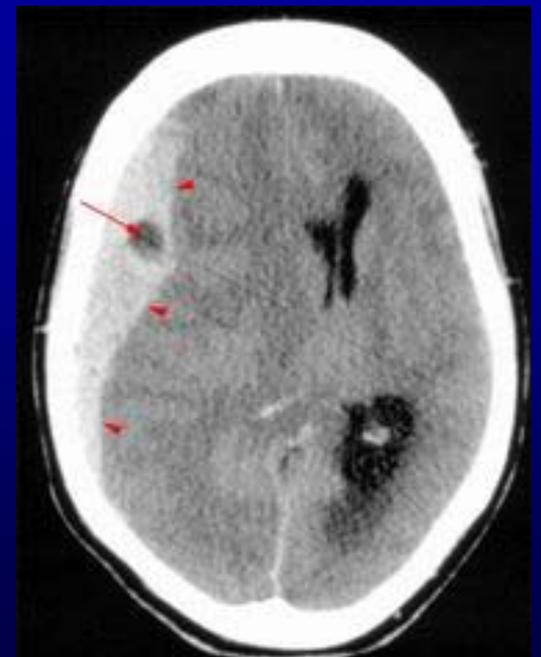
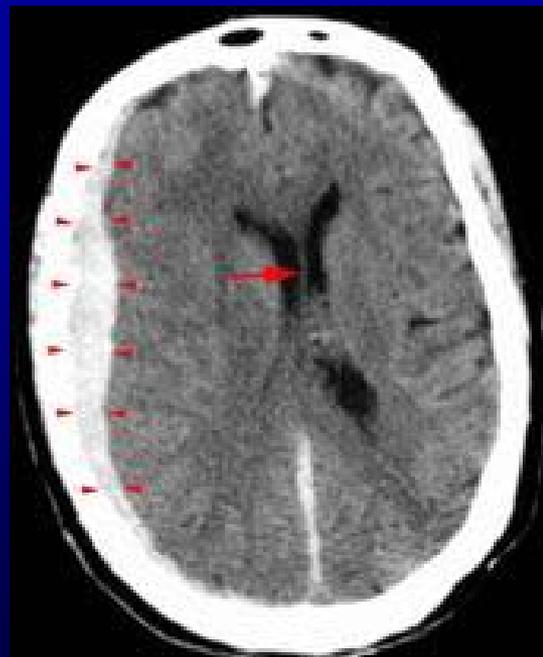
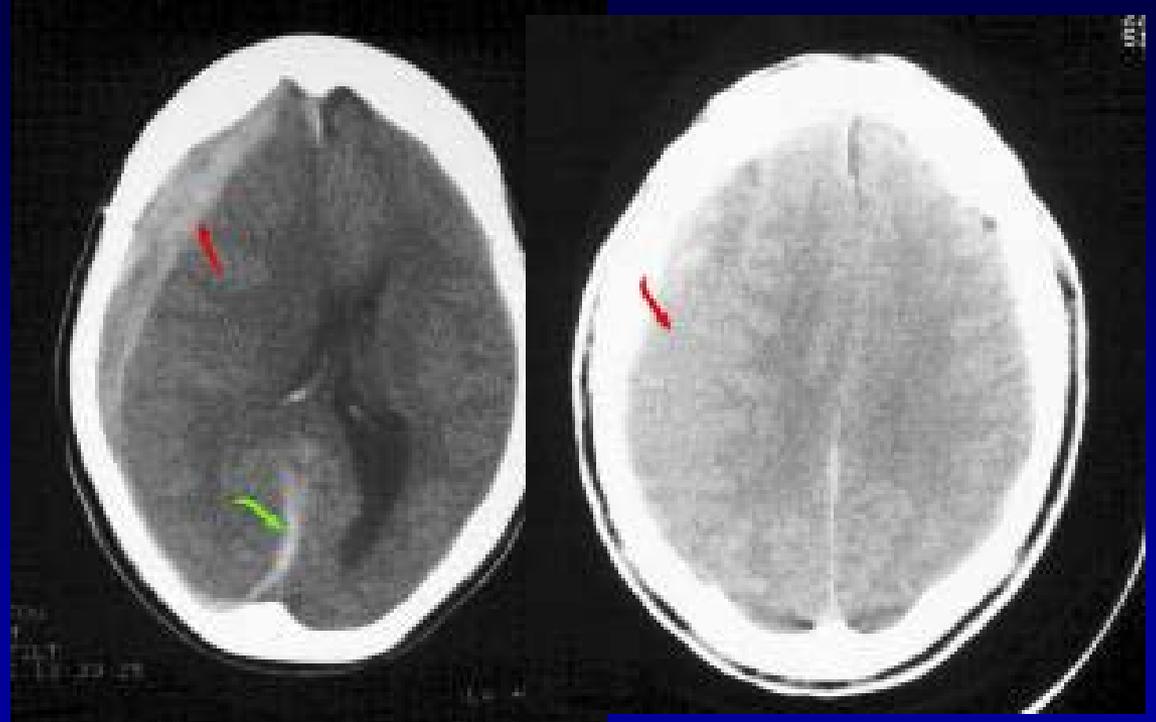


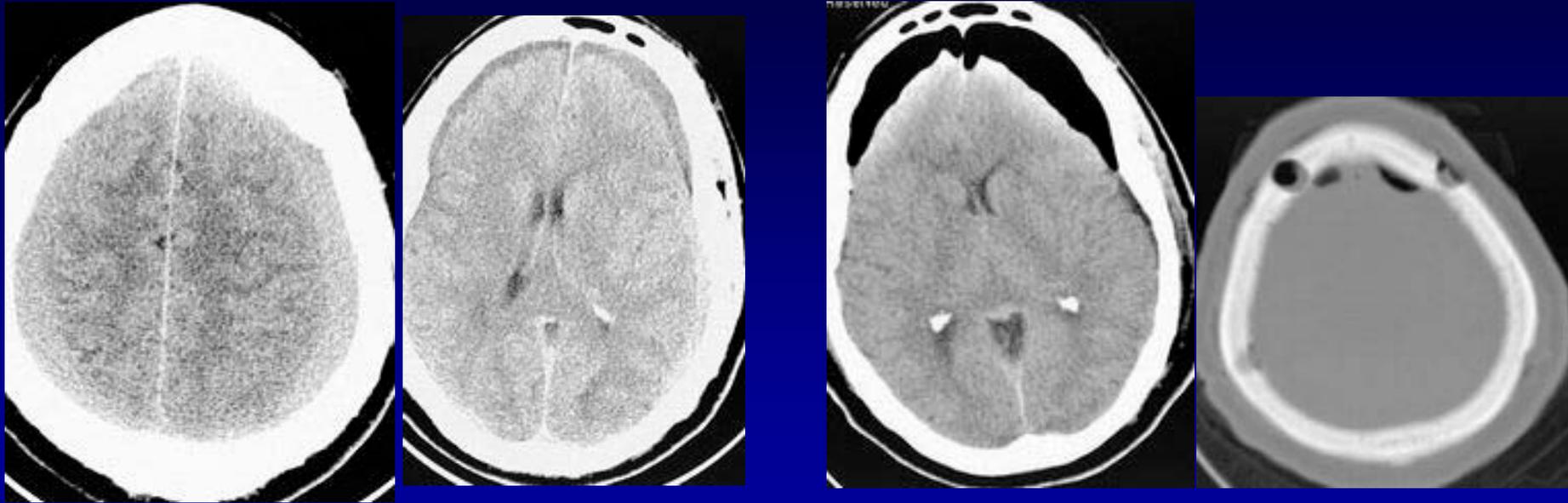




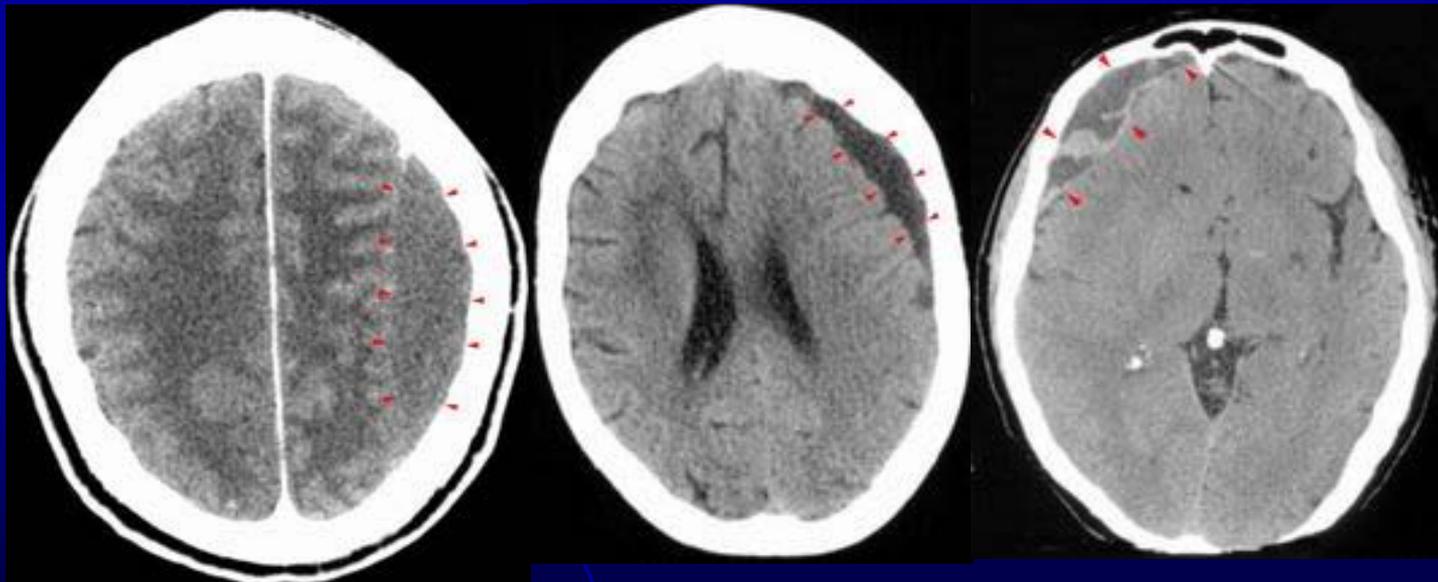
**Hematomas epidurales**

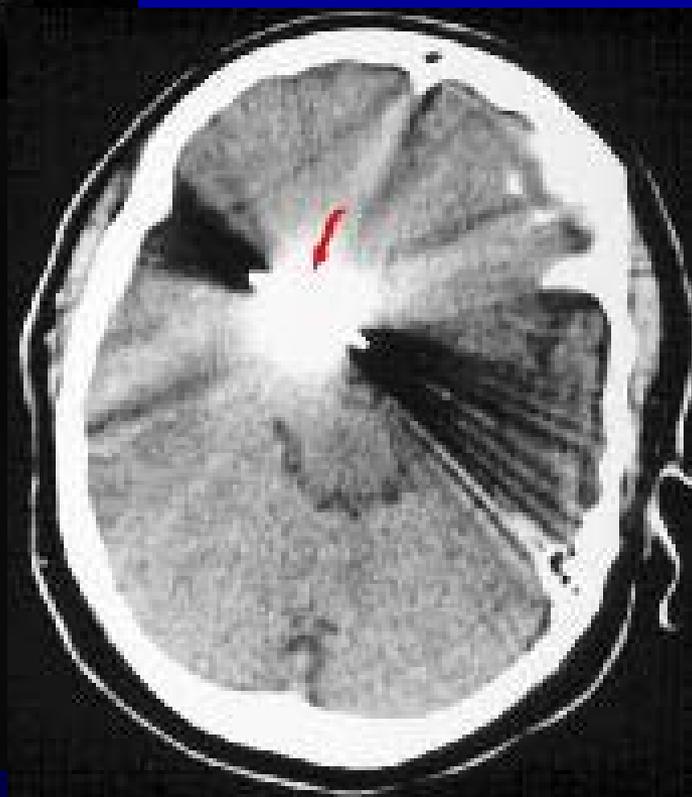
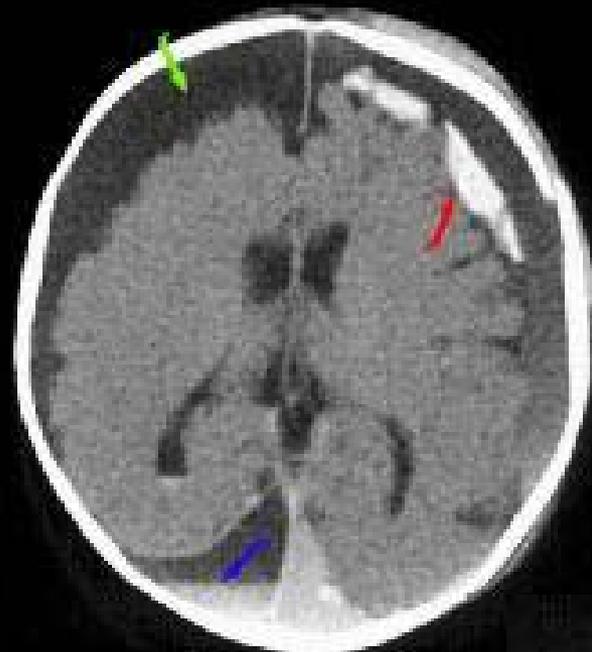
# Hematomas subdurales agudos

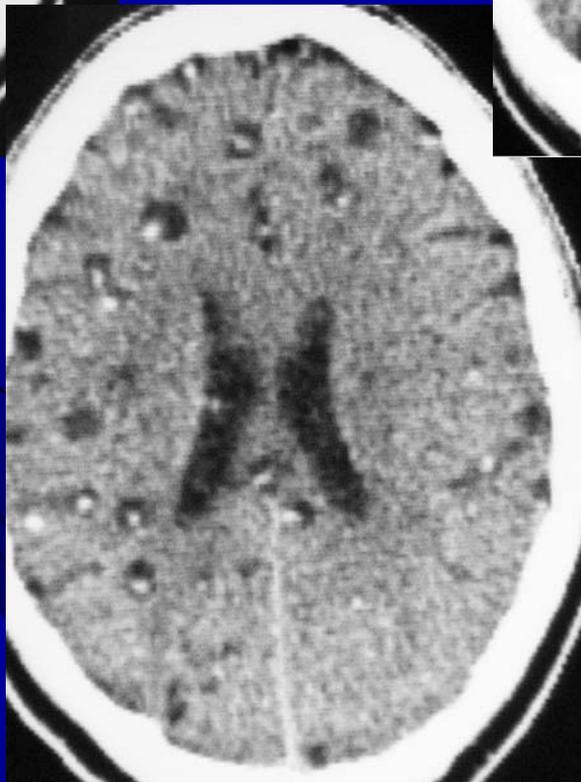
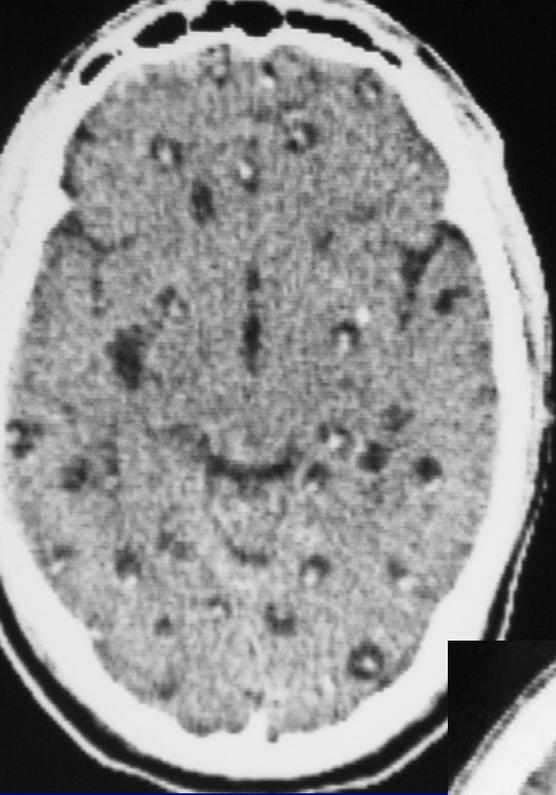


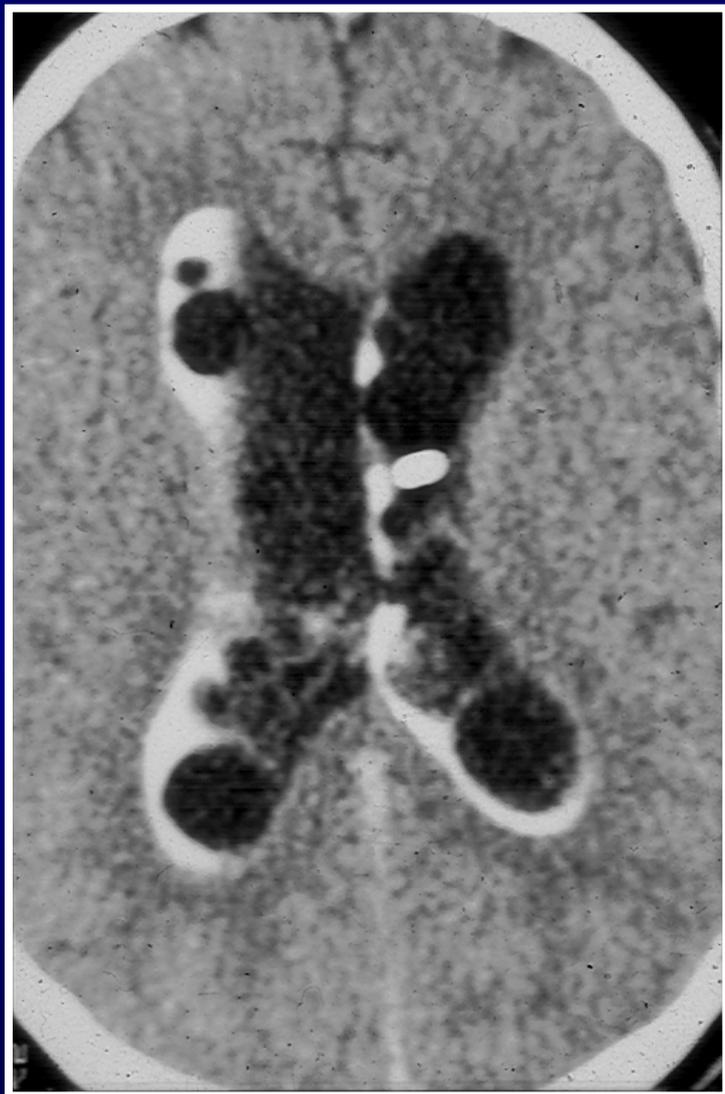
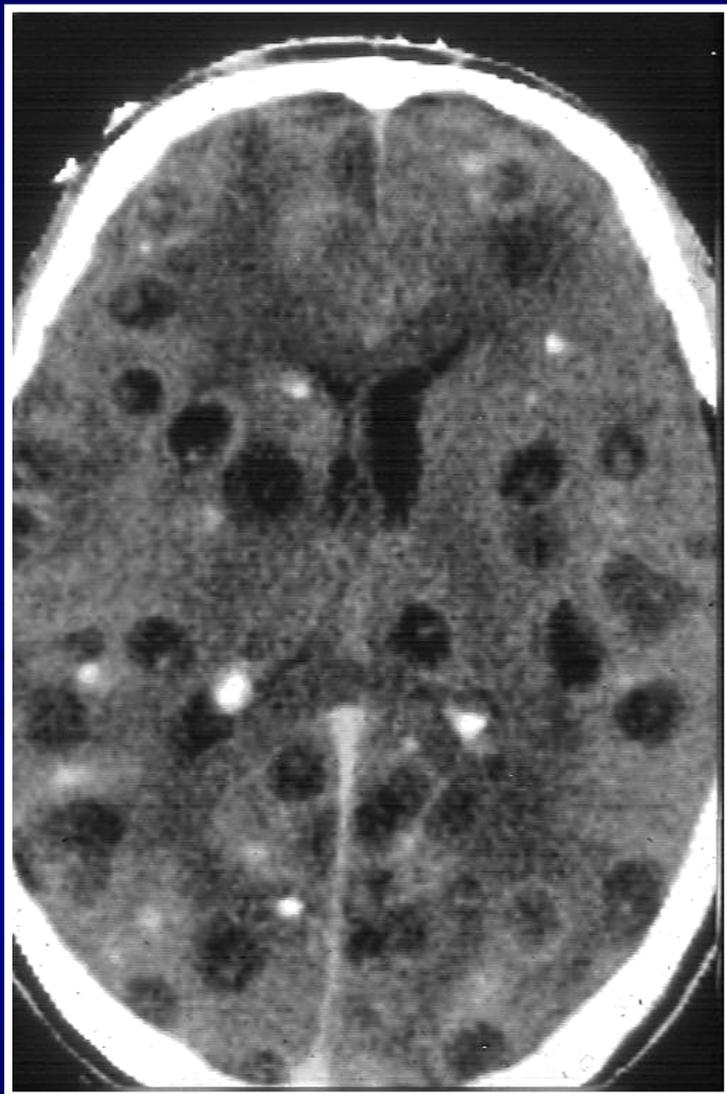


## Hematomas subdurales crónicos

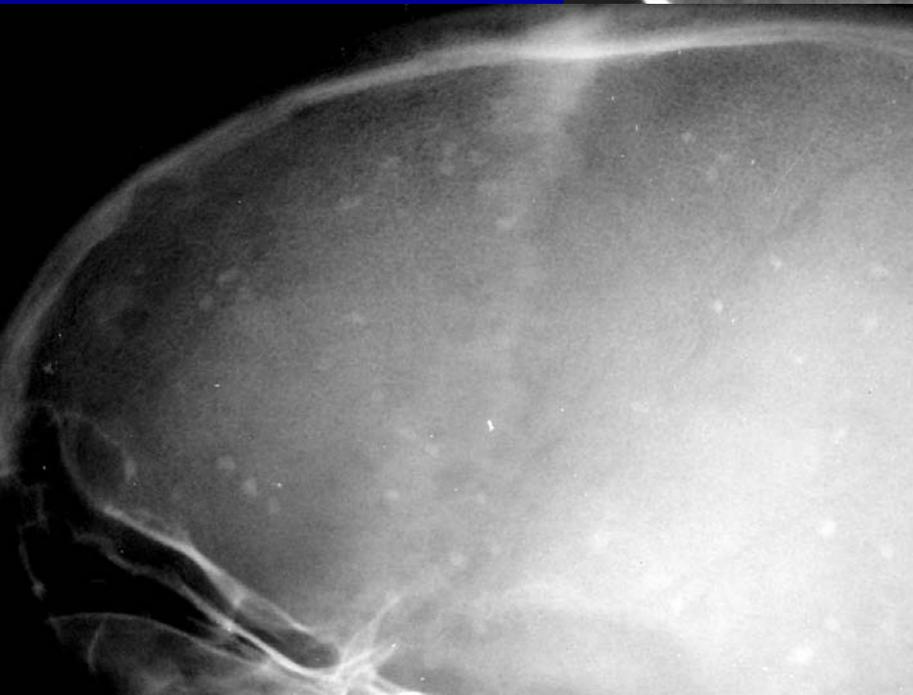
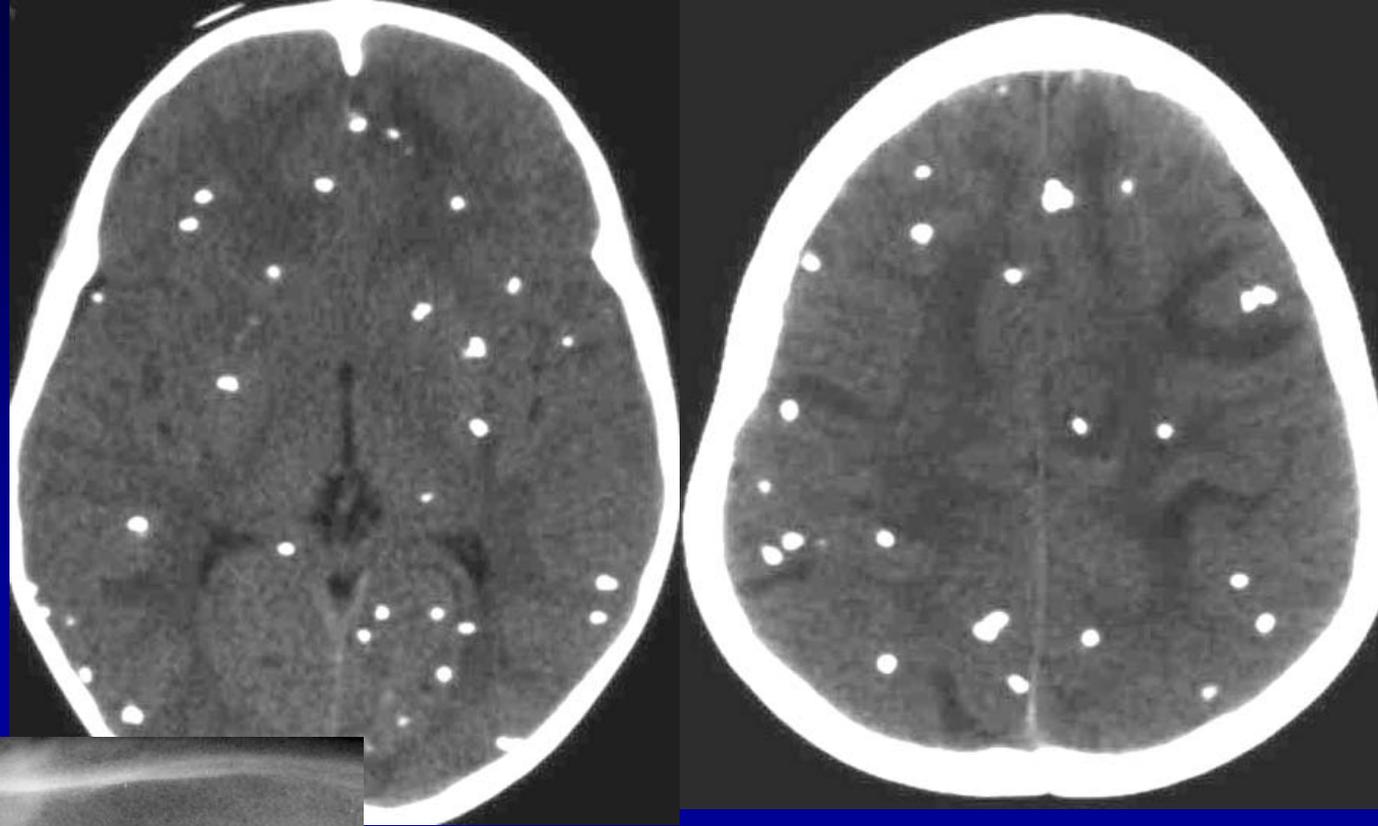








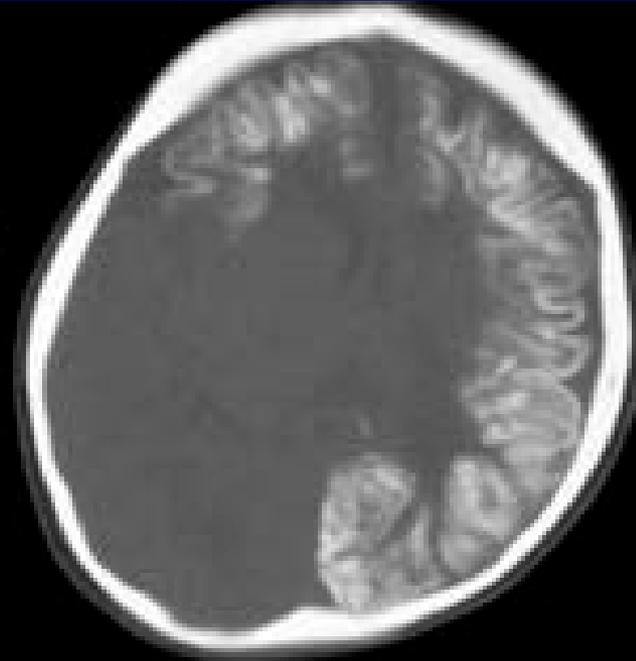
# Cisticercosis



Cisticercos calcificados en niña portuguesa de 3 años



**Sturge Weber**  
**(niña de 4 años)**  
**Angiomatosis leptomeníngea**  
**Nevus facial**  
**(Facomatosis o Síndromes neurocutáneos)**



# Agentes de Contraste:

Aumentan el contraste de la imagen

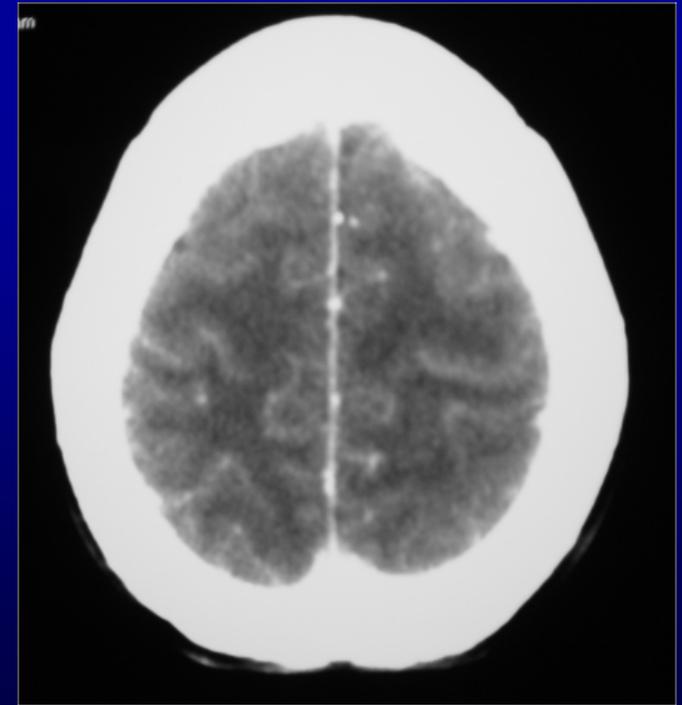
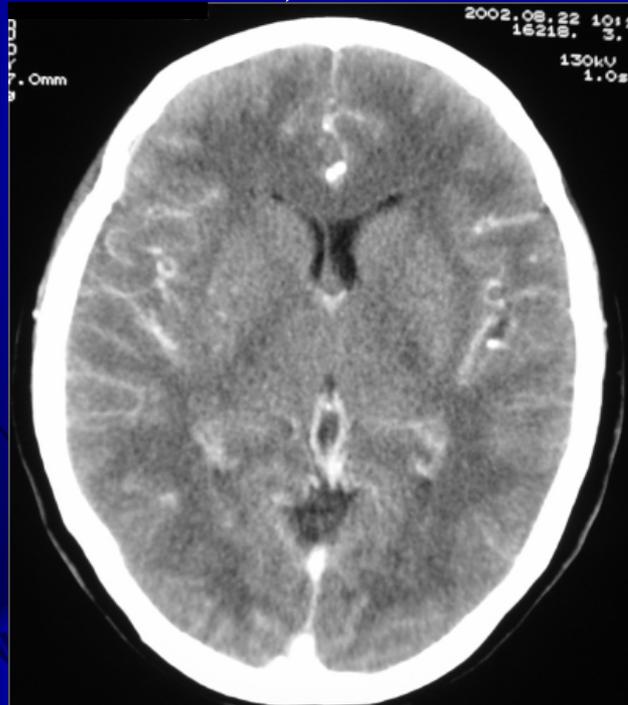
Administración vía venosa

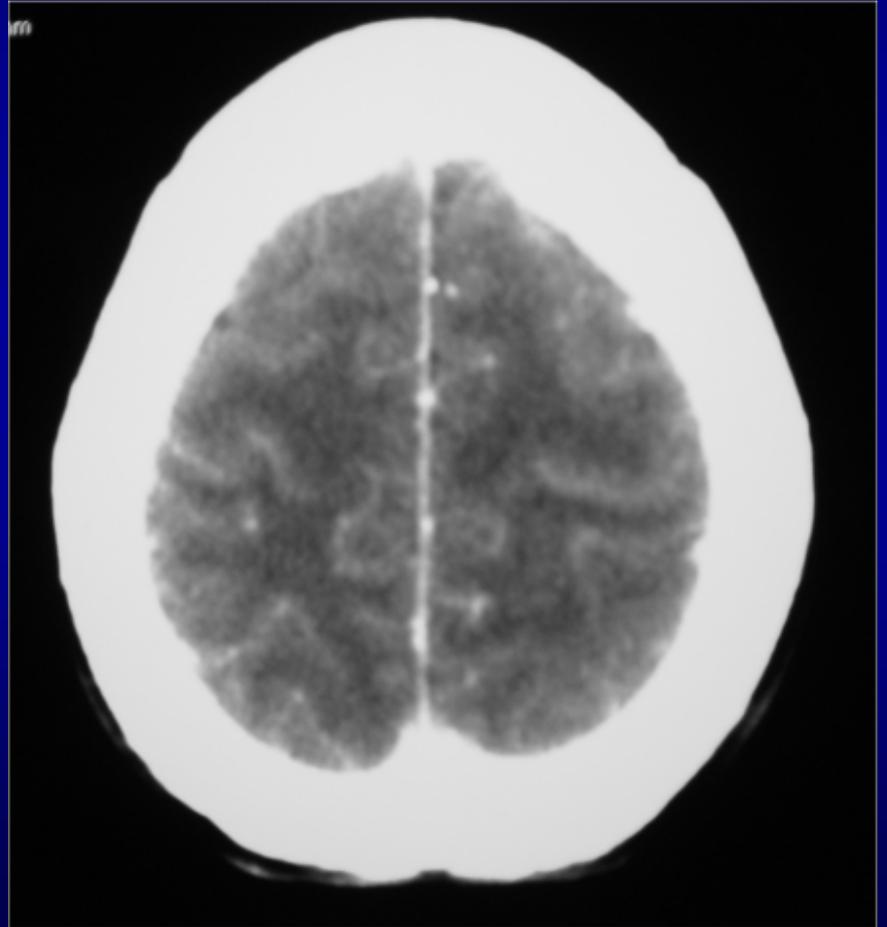
Vías de eliminación (renal)

Aumentan la densidad de las estructuras vasculares

Mejoran la detección lesional

Determinan las características fisiológicas y funcionales del parénquima (**análisis de la barrera hemato-encefálica**)

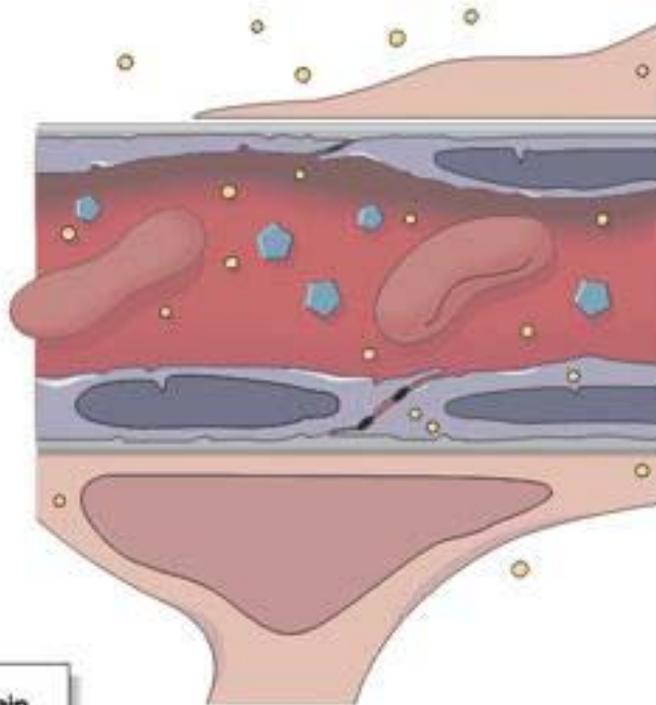




# Agentes de Contraste: Iodados

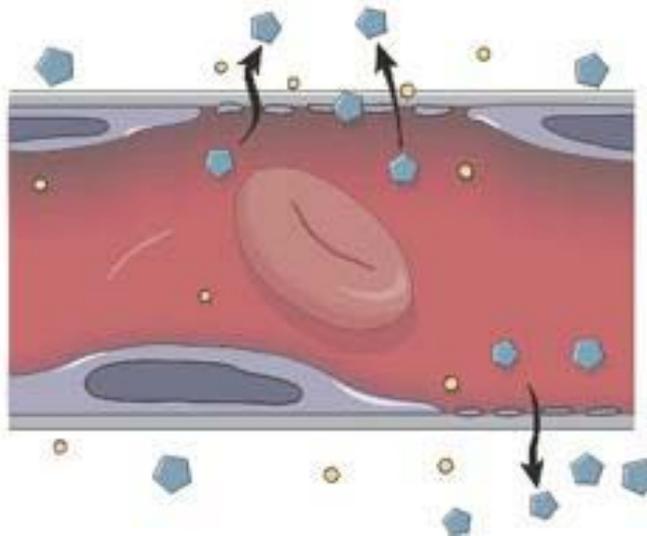


Blood-Brain Barrier



- Protein
- Glucose

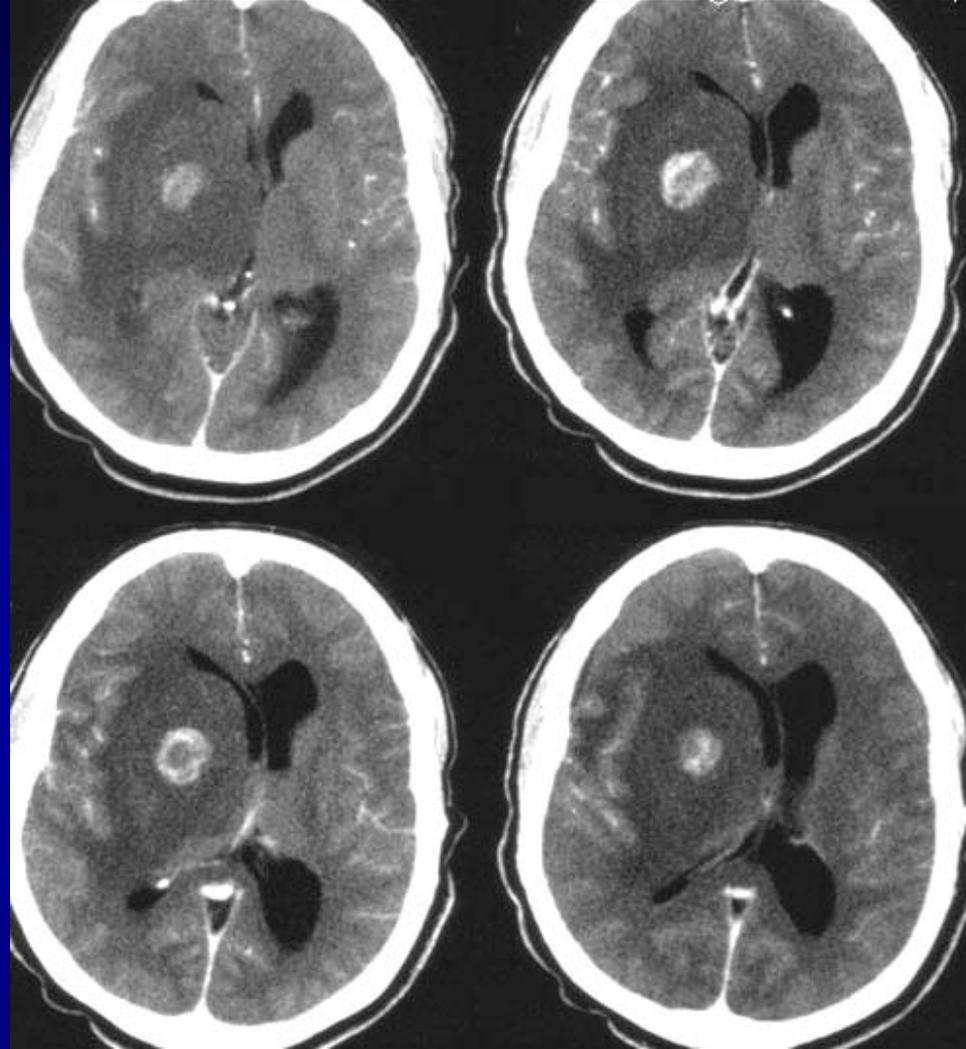
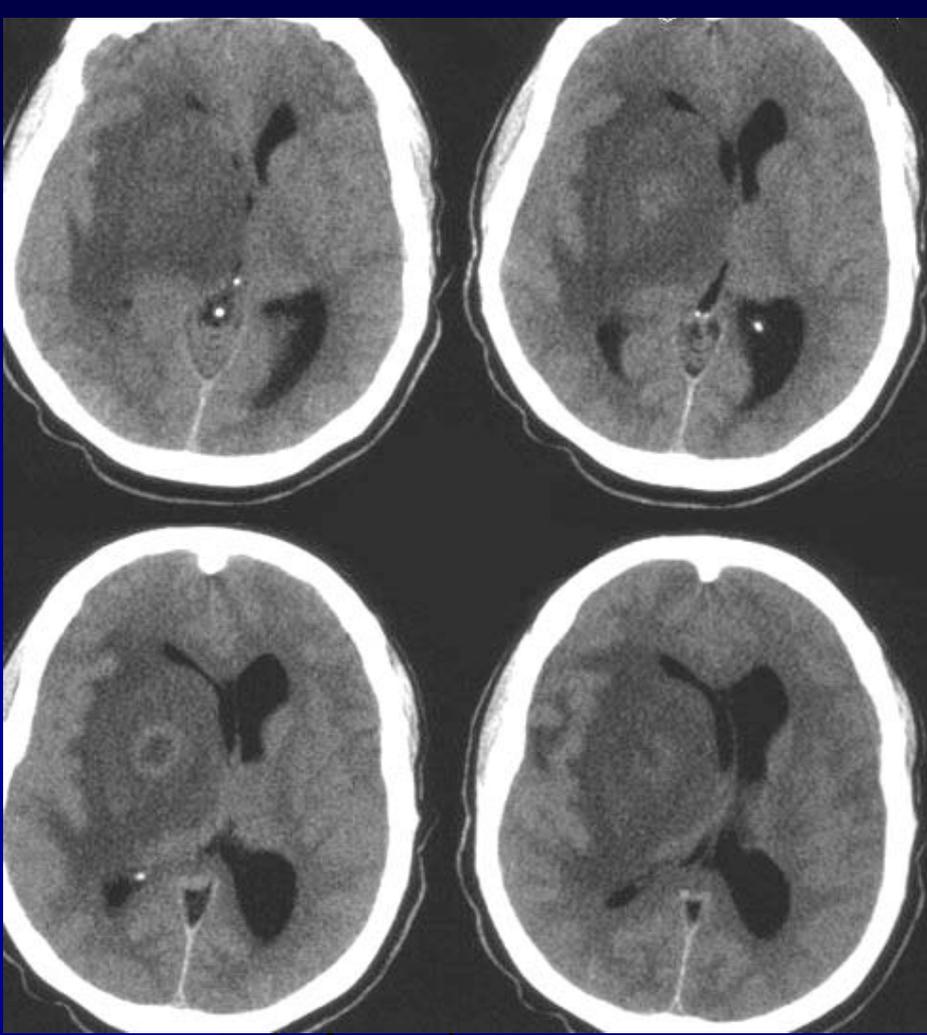
No Blood-Brain Barrier



## Barrera hemato-encefálica

Mecanismo de filtro que restringe el paso de sustancias al cerebro.

Se puede alterar con manitol  
No la pasan los contrastes



## **Toxoplasmosis**

TC sin y con contraste, anillo de captación rodeado de amplia zona de edema



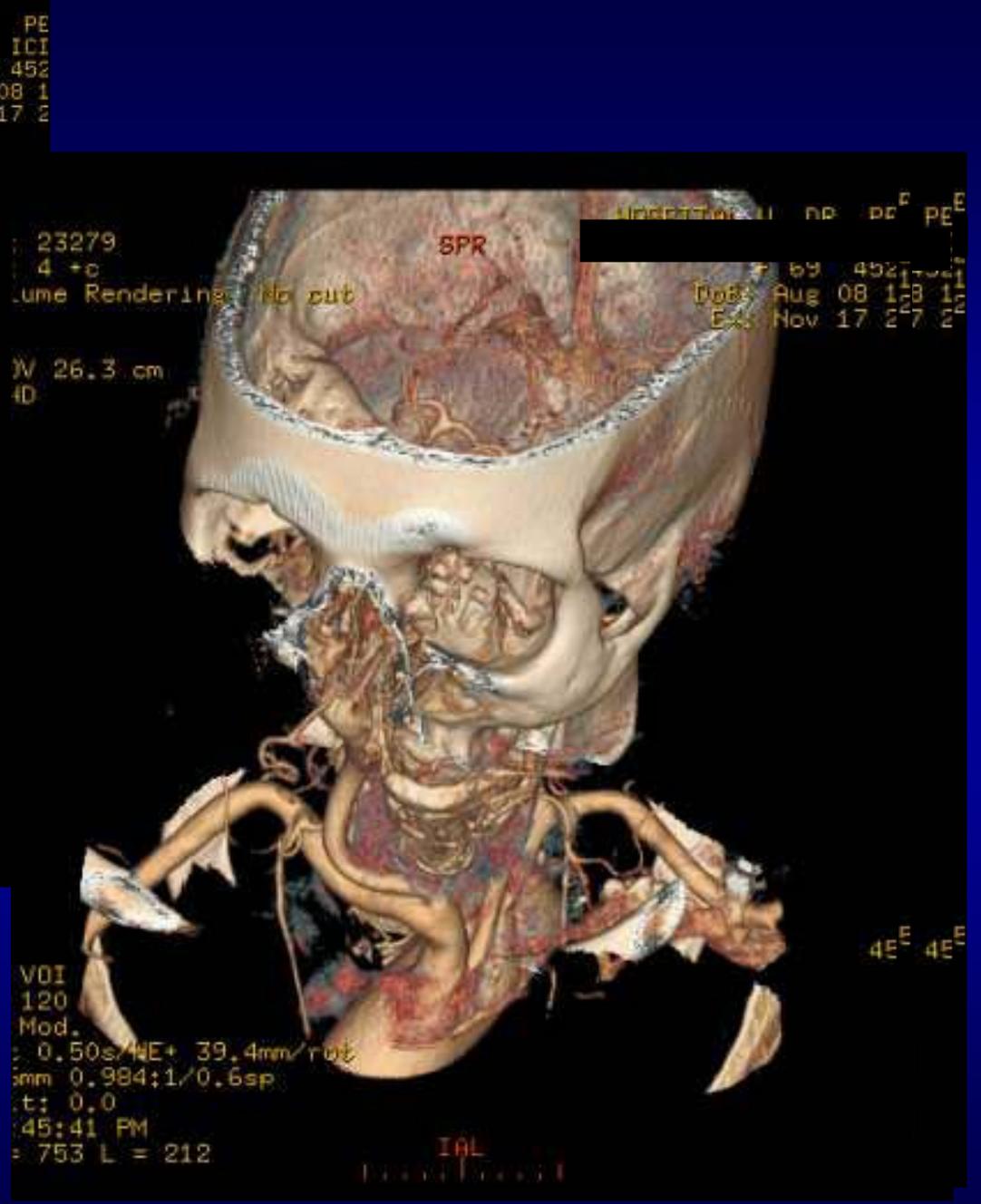
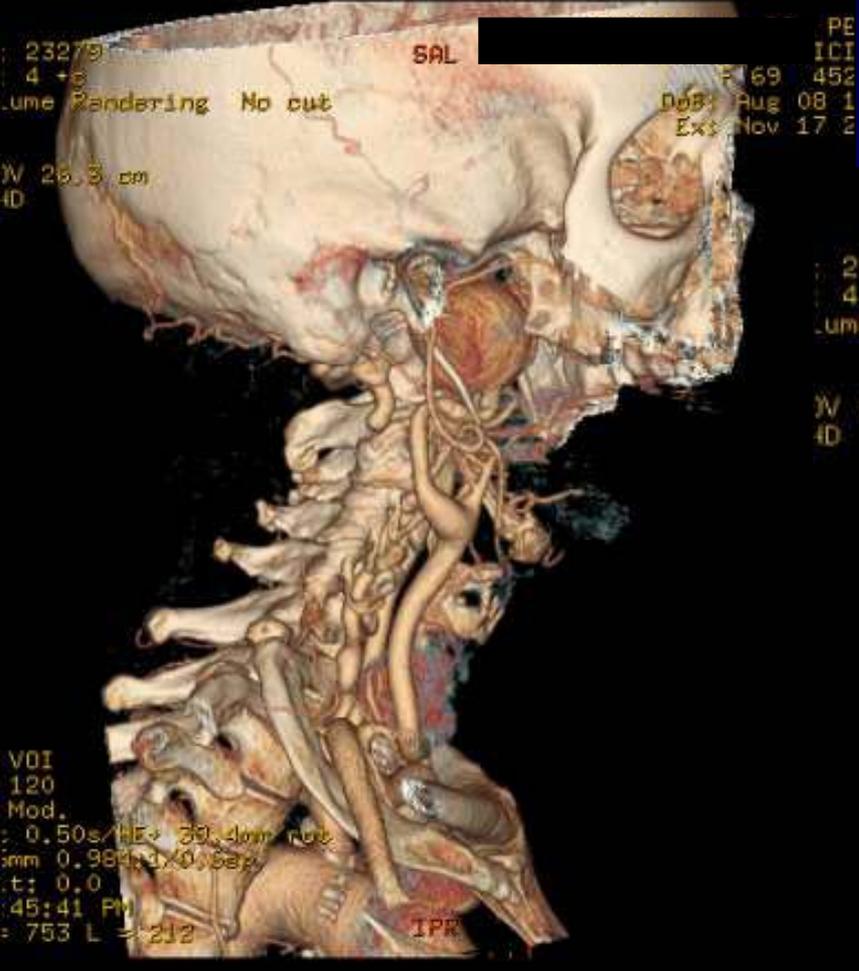
L= 17



L= 22

CONTRASTE

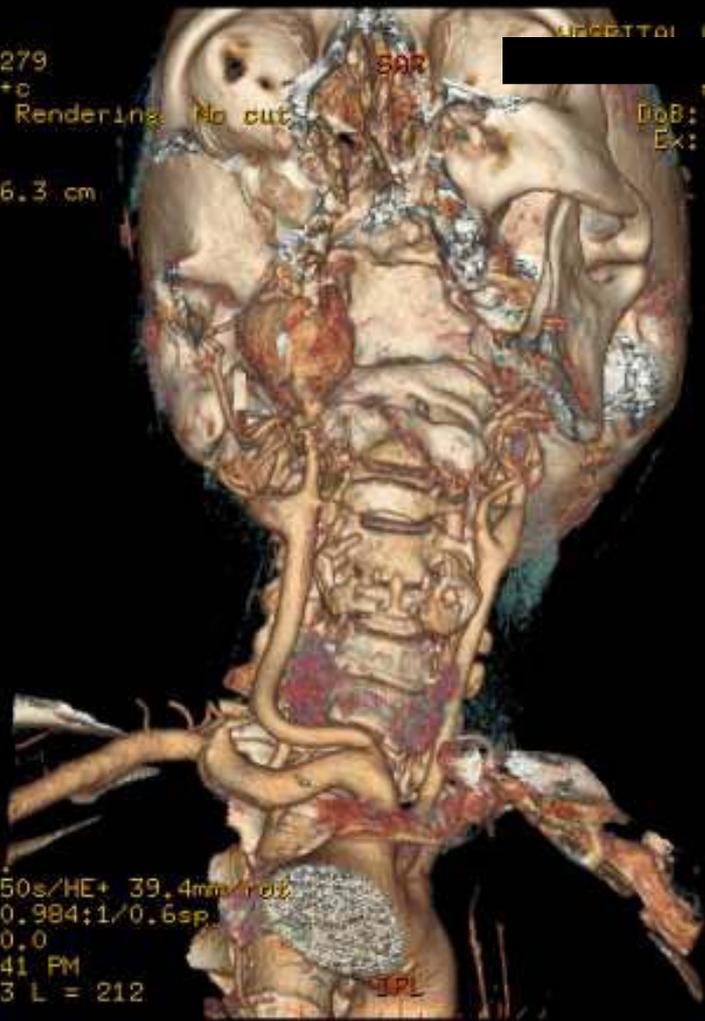
**Astrocitoma**



23279  
4 +c  
Volume Rendering No cut

W 26.3 cm  
ID

VOI  
120  
Mod.  
: 0.50s/HE+ 39.4mm/rot  
mm 0.984:1/0.6sp.  
t: 0.0  
:45:41 PM  
= 753 L = 212



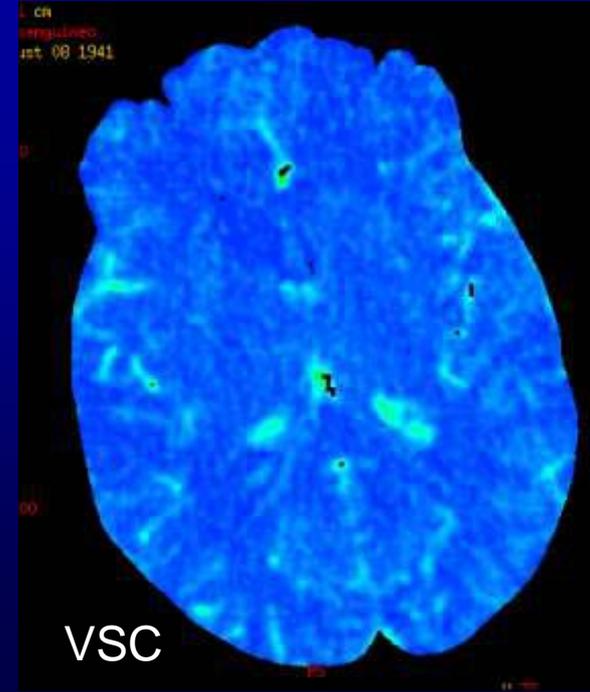
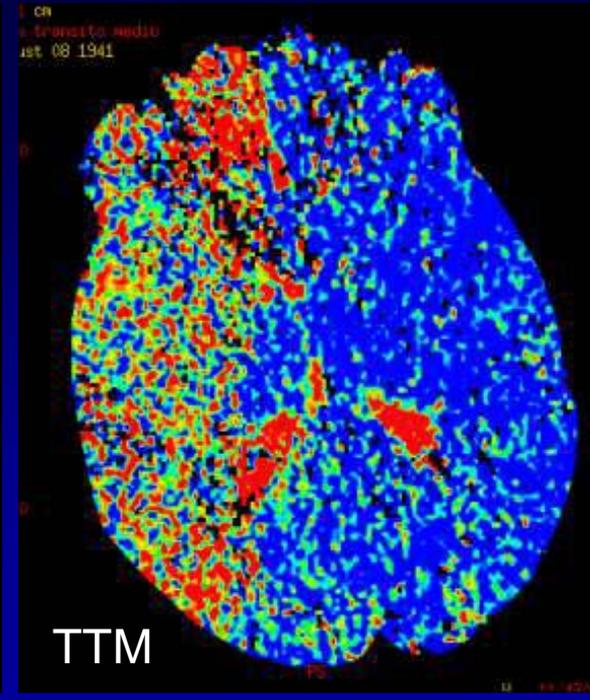
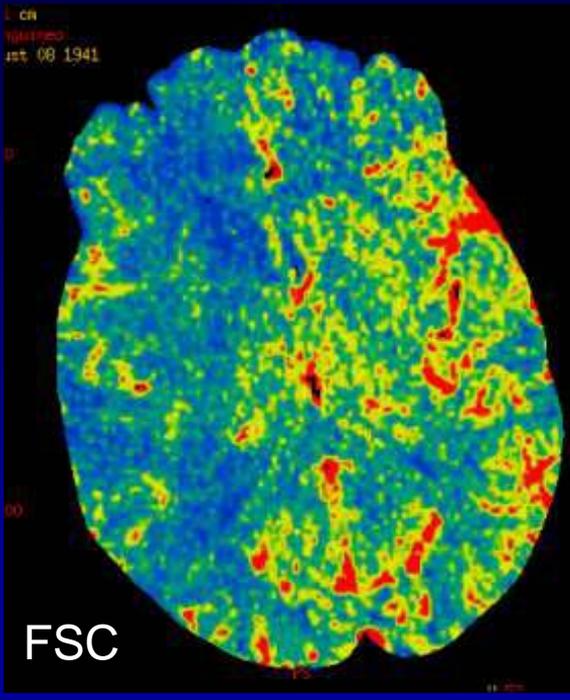
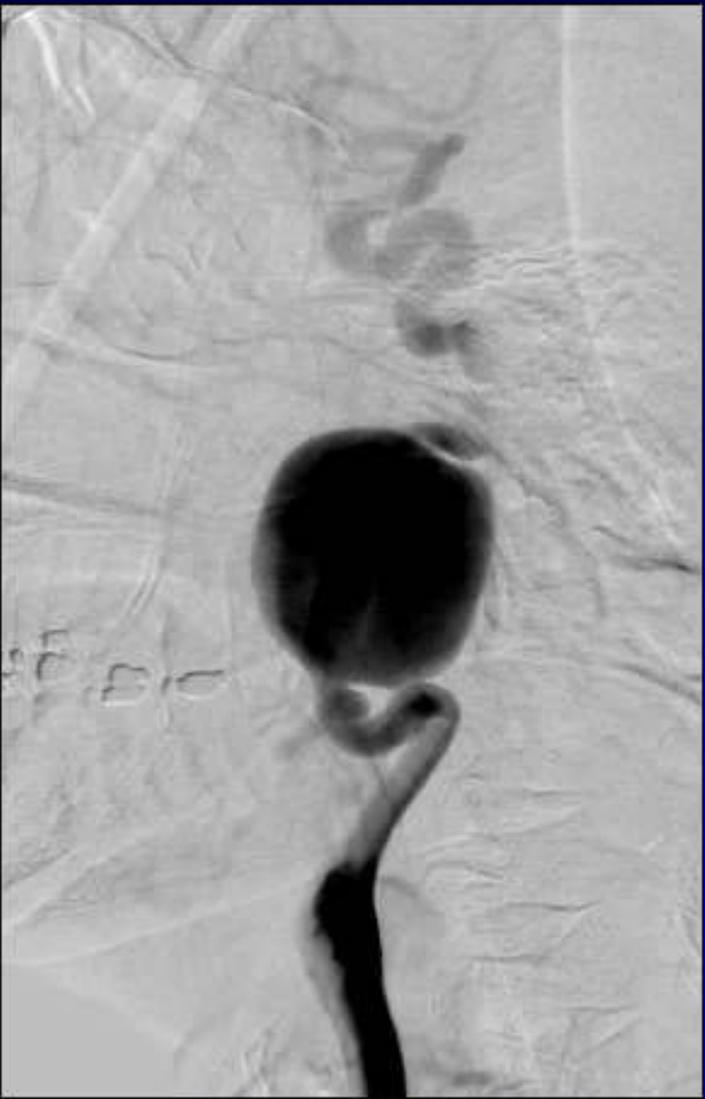
ACBITAL II RP DR  
F 65 49  
DoB: Aug 08 1  
Ex: Nov 17 02

ering No cut

5  
4!



DoB: Aug  
Ex: Nov 6  
F 65  
u  
o



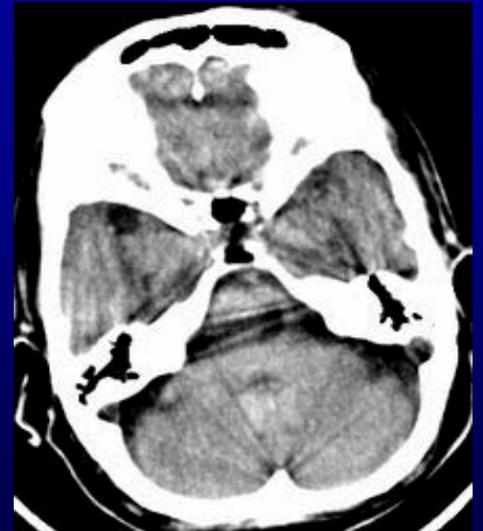
Perfusión cerebral y angiografía

# Ventajas de la TC:

- Disponibilidad
- Bajo costo relativo
- Gran capacidad diagnóstica traumatismos y hematomas
- Estudio estructuras óseas
- Relativamente inocua
- Menor colaboración que la RM
- Menos claustrofobia que la RM

# Desventajas de la TC:

- Poco contraste entre sustancias gris y blanca
- Radiación ionizante
- Artefactos en estructuras basales
- Planos transversales
- Reacciones alérgicas al contraste iodado
- Insuficiencia renal





F. Bloch      E. Purcell  
Suizo            MIT  
1946 → P. Nobel 1952

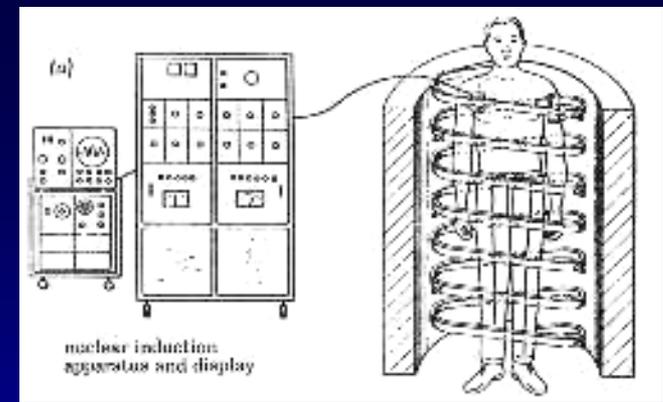
Propiedades magnéticas de algunos núcleos  
Resonancia Magnética Nuclear



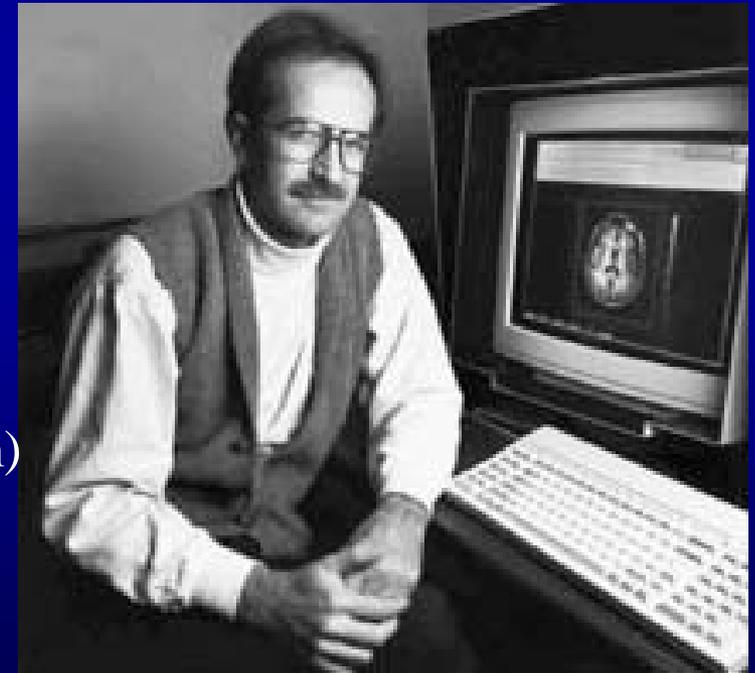
Físicos:  
Peter Mansfield (Nottingham)  
Premio Nobel 2003



Paul Lauterbur 1973-75  
Nueva York → Illinois  
Premio Nobel 2003



Raymond Damadian MD. 1971-74  
1º Cuerpo humano



Dr. Kamil Ugurbil 1992 - RMF



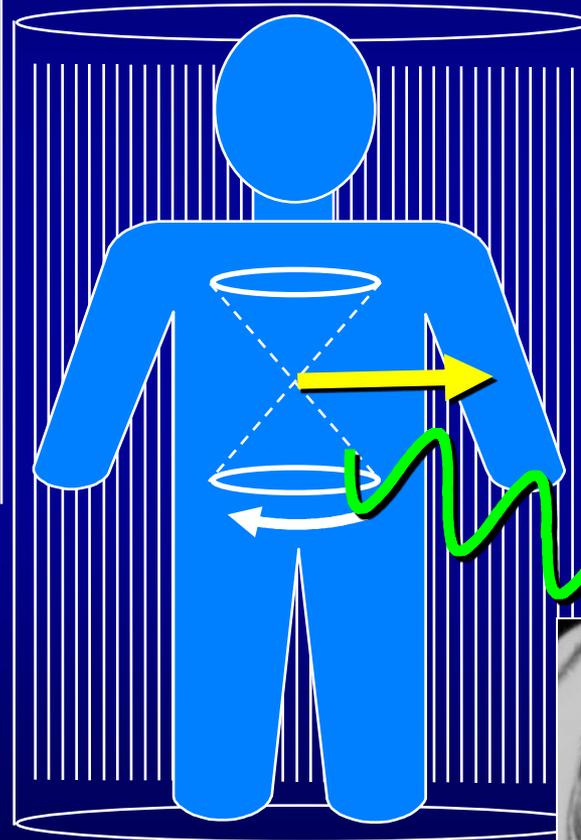
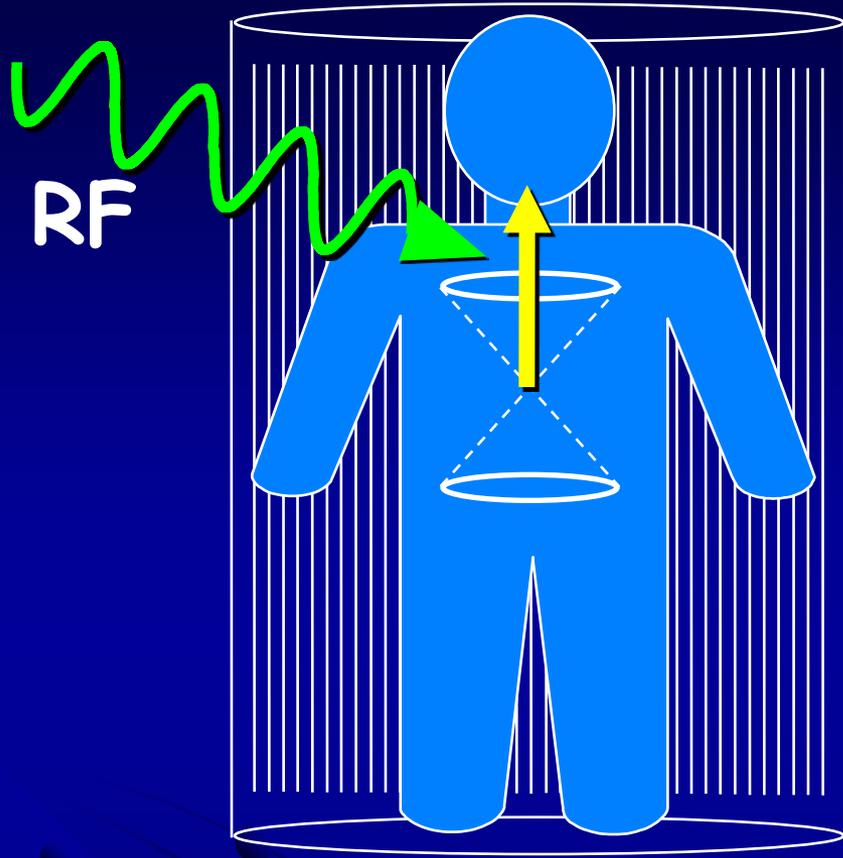
← 1988 Valencia 0,5 Tesla

2002 1,5 Tesla

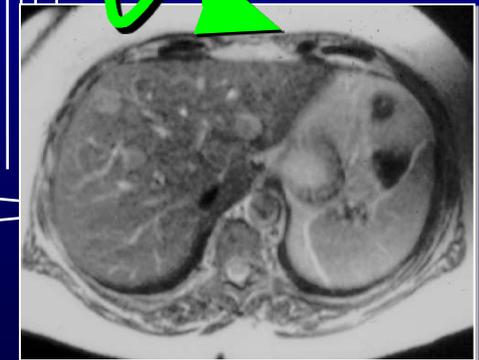


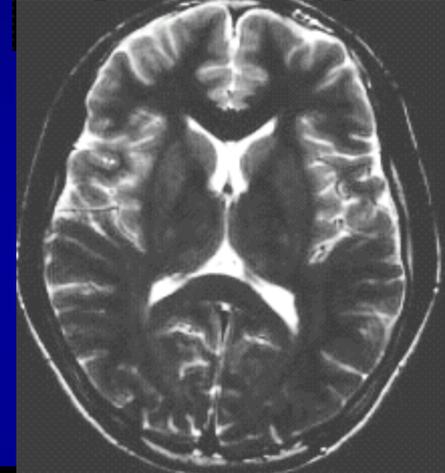
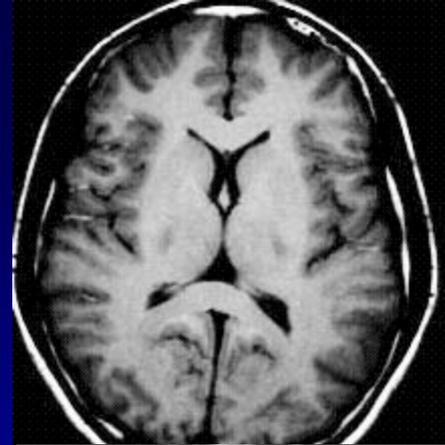
3T

# Interacción de un Campo Magnético y Radiofrecuencia

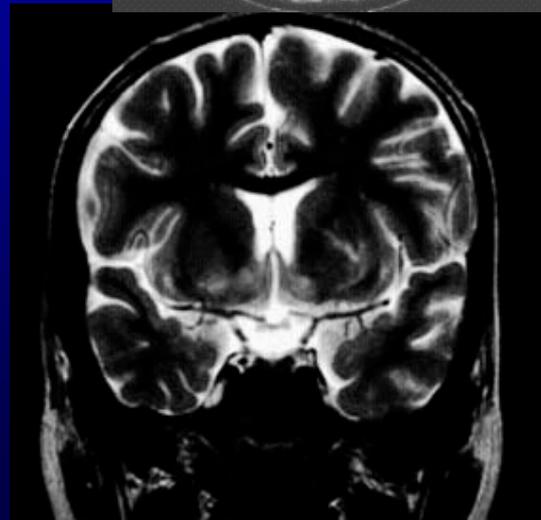
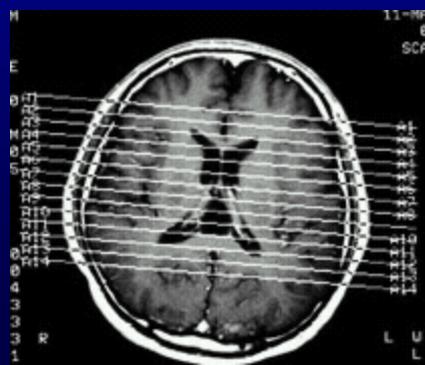
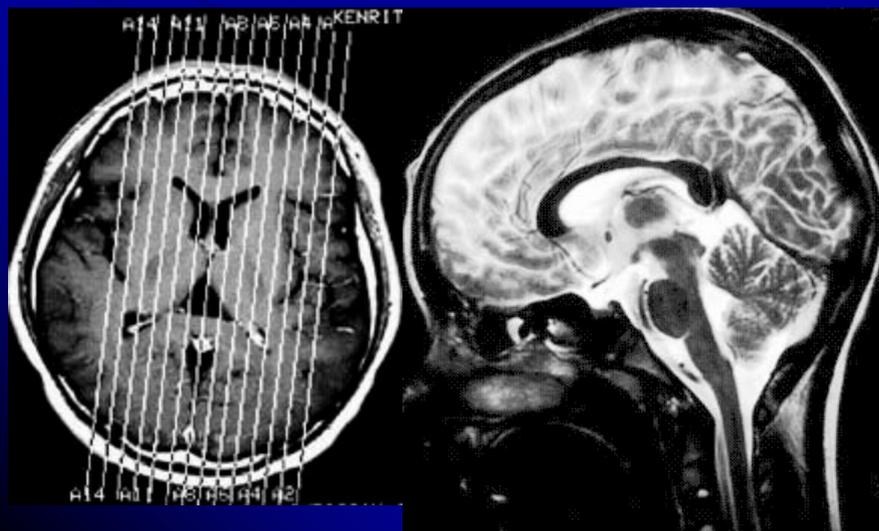


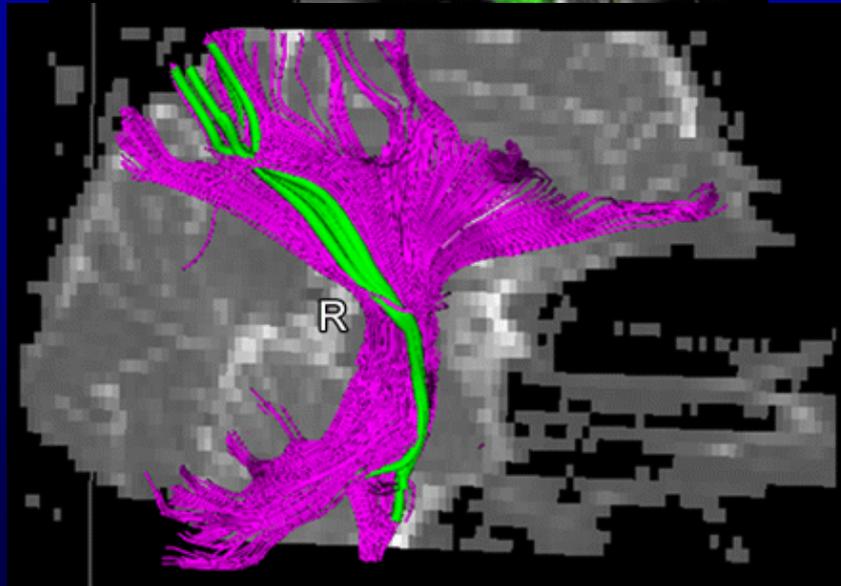
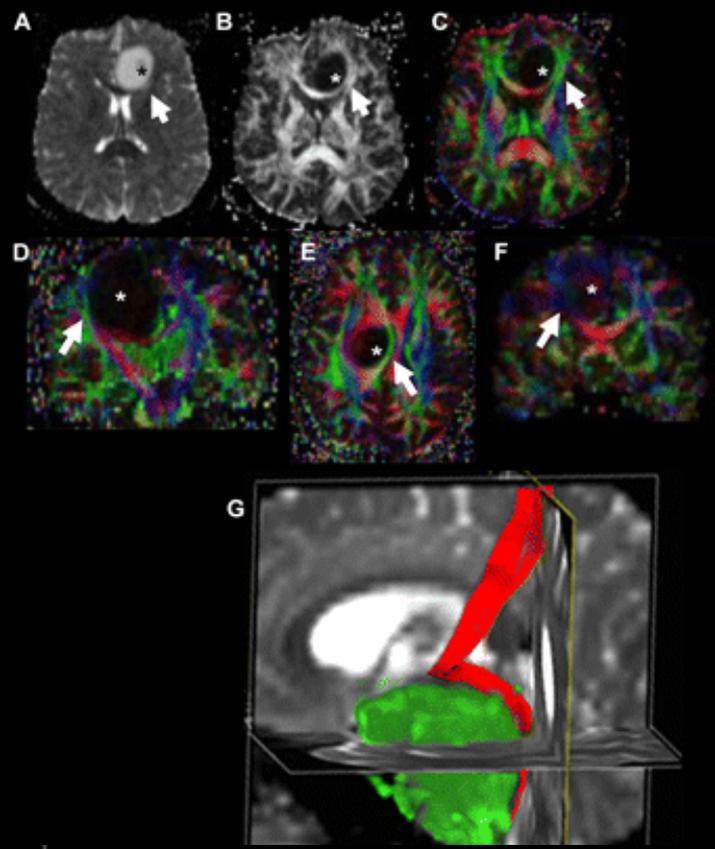
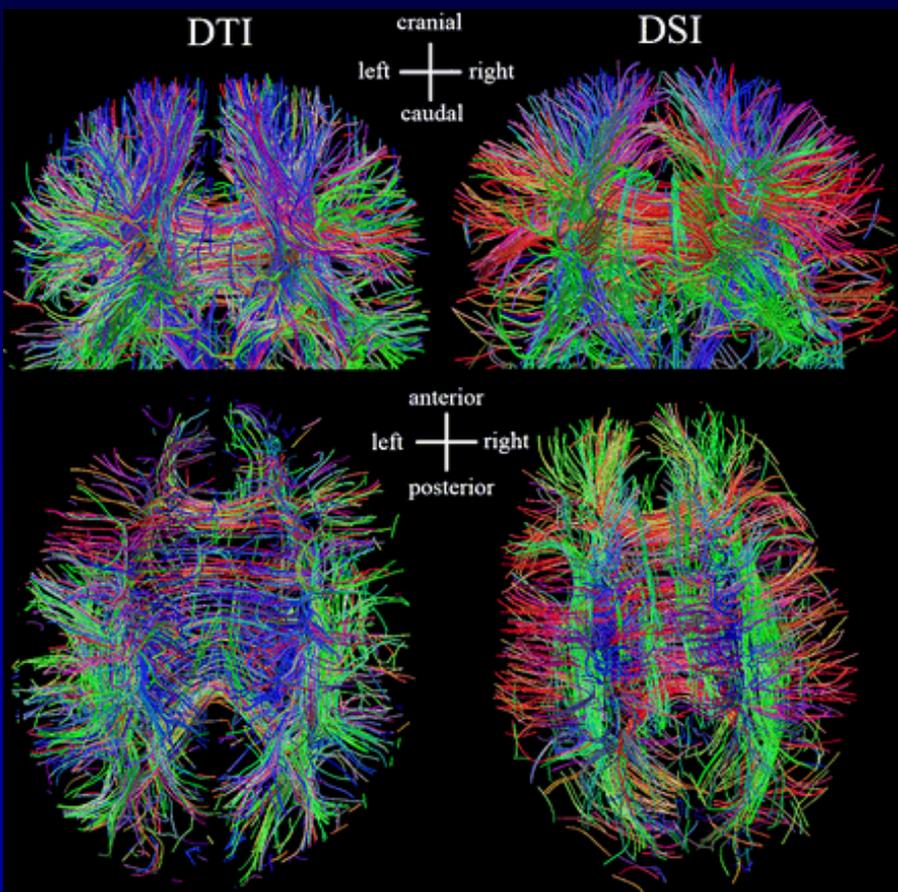
$H^+ \rightarrow 1T \rightarrow 42,58 \text{ MHzs}$   
 $1,5T \rightarrow 63,85 \text{ MHzs}$



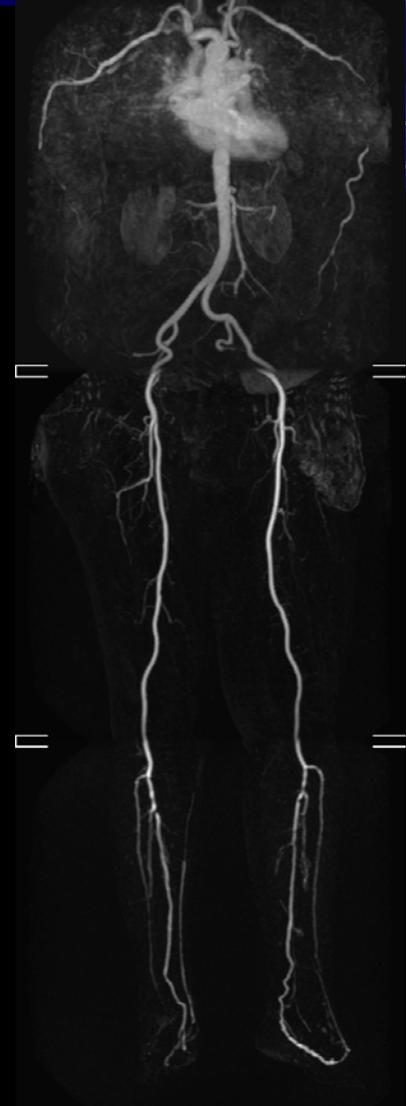
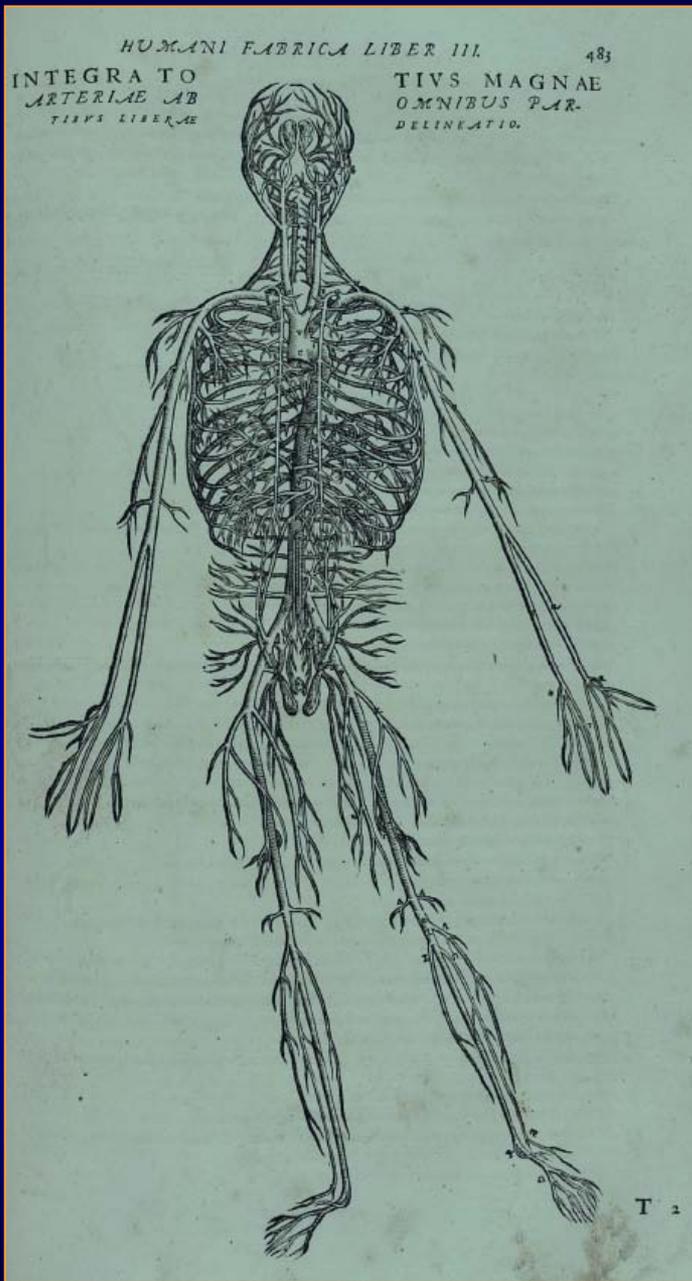
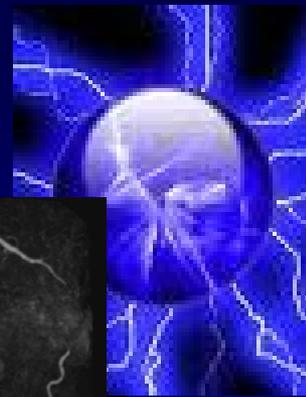


RM  
IRM  
ARM  
SRM  
RMF

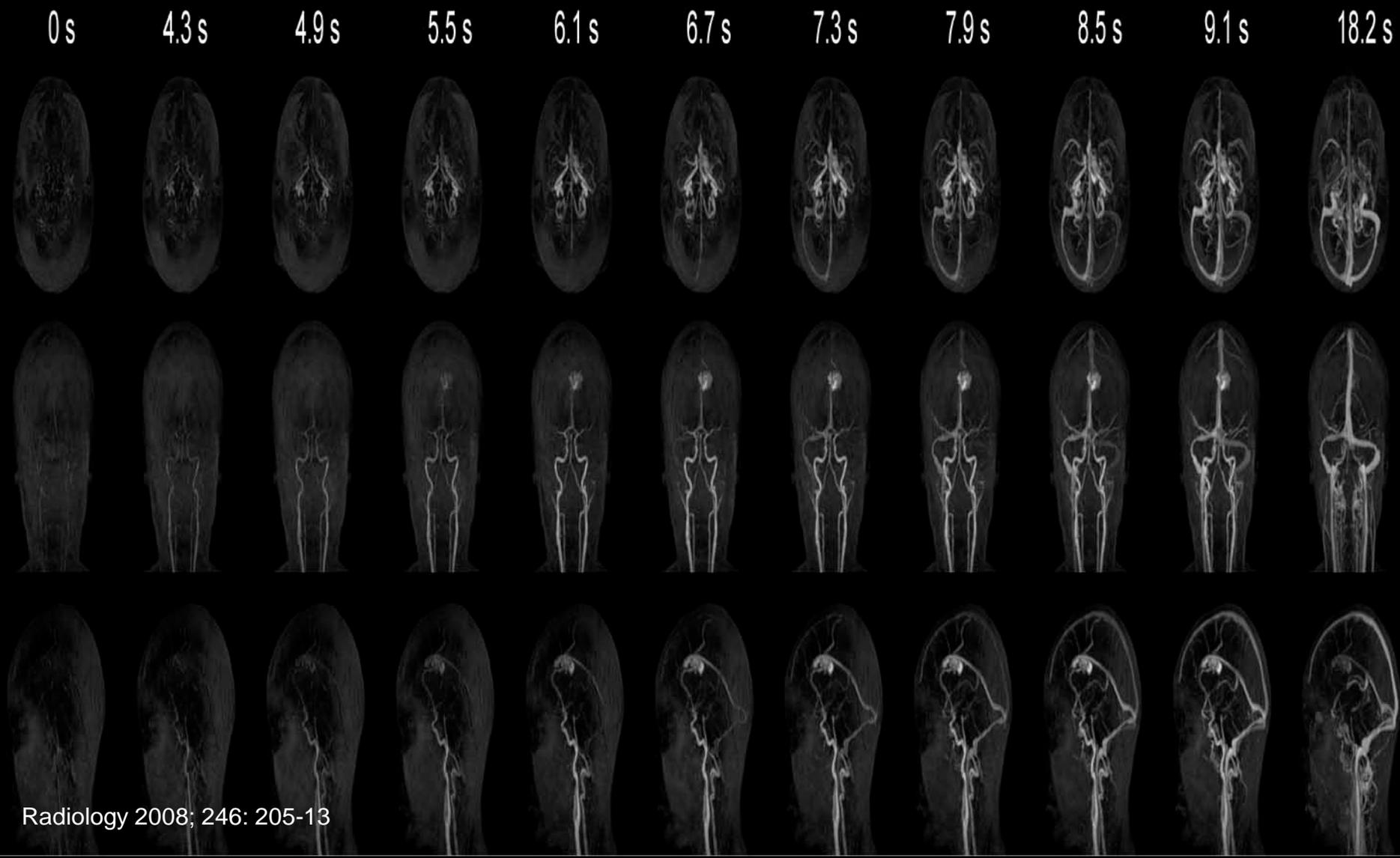




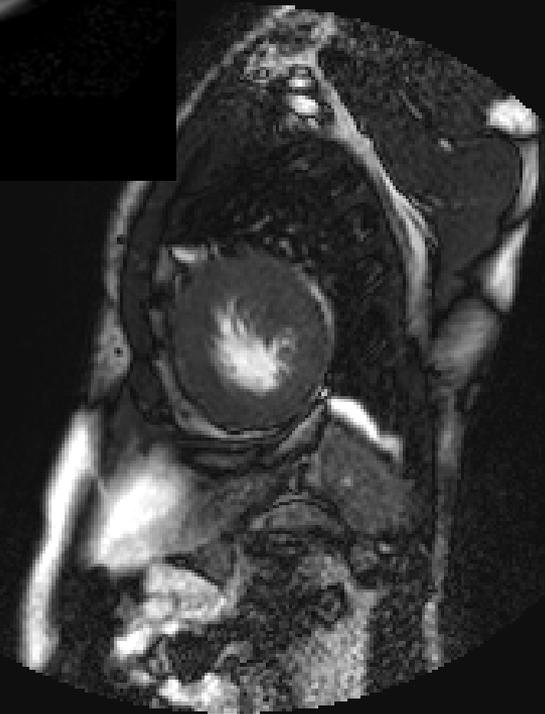
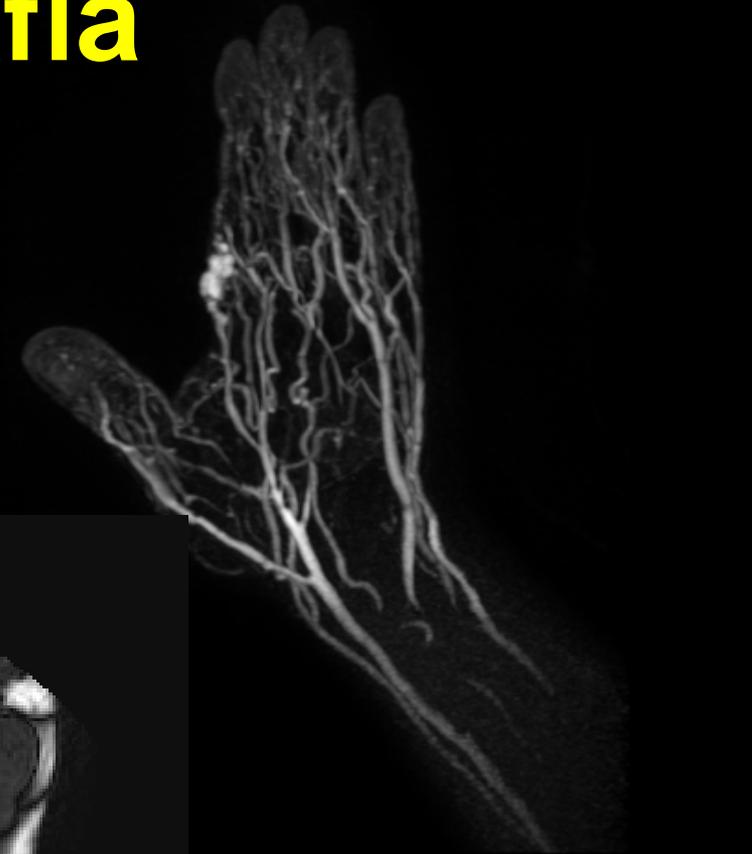
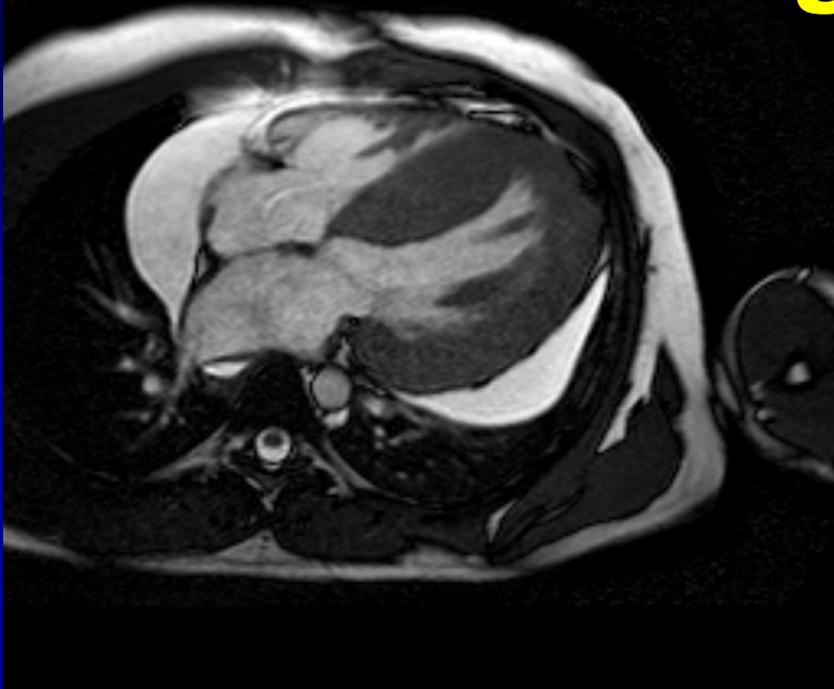
# De Vesalio 1543 al 2010 y más allá



# RM Vascular: Técnica 4D



# RM Angiografía

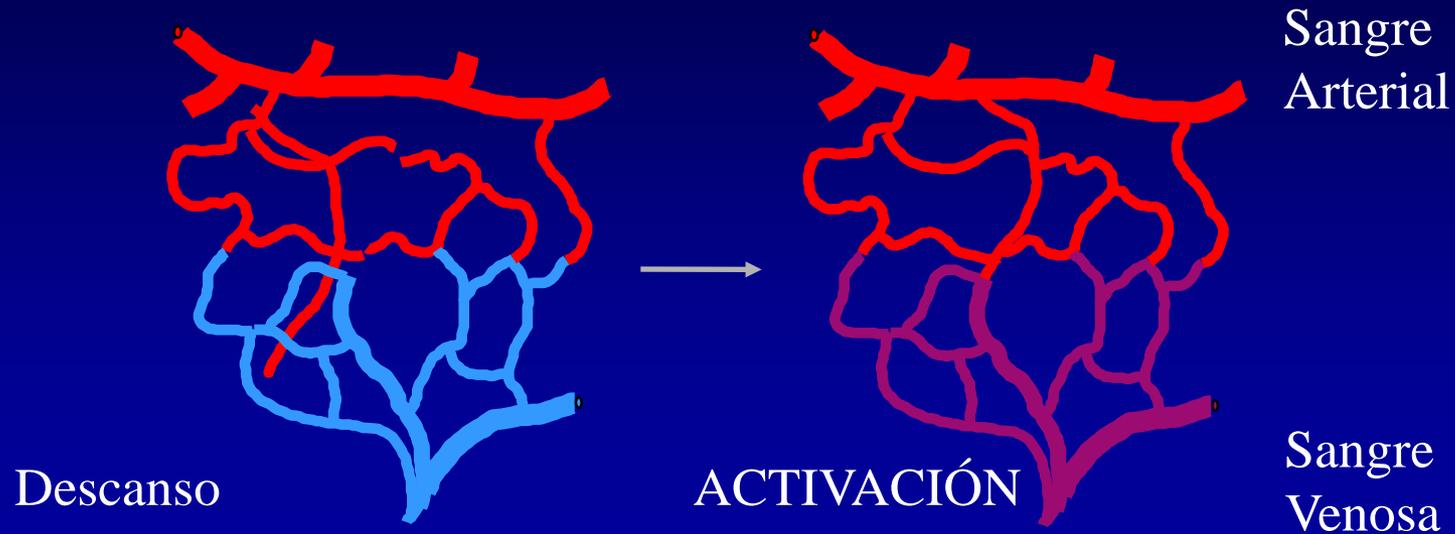


# Activación Cerebral

**Cerebro → 2 % del peso corporal**  
**→ 15 % del gasto cardiaco**  
**→ 25 % del consumo de oxígeno**

**Autoregulación del flujo cerebral en función de su actividad**

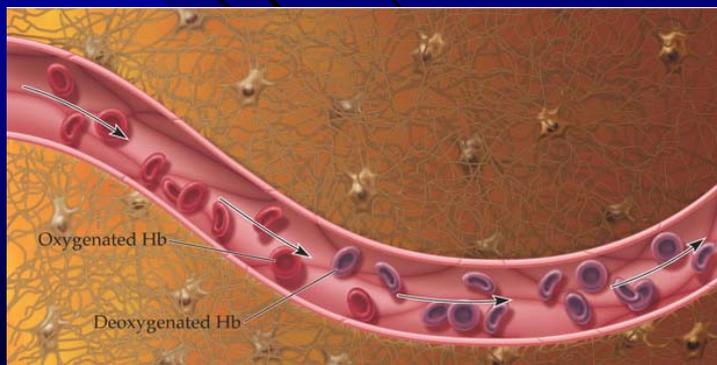
# Activación Cerebral → RM Funcional



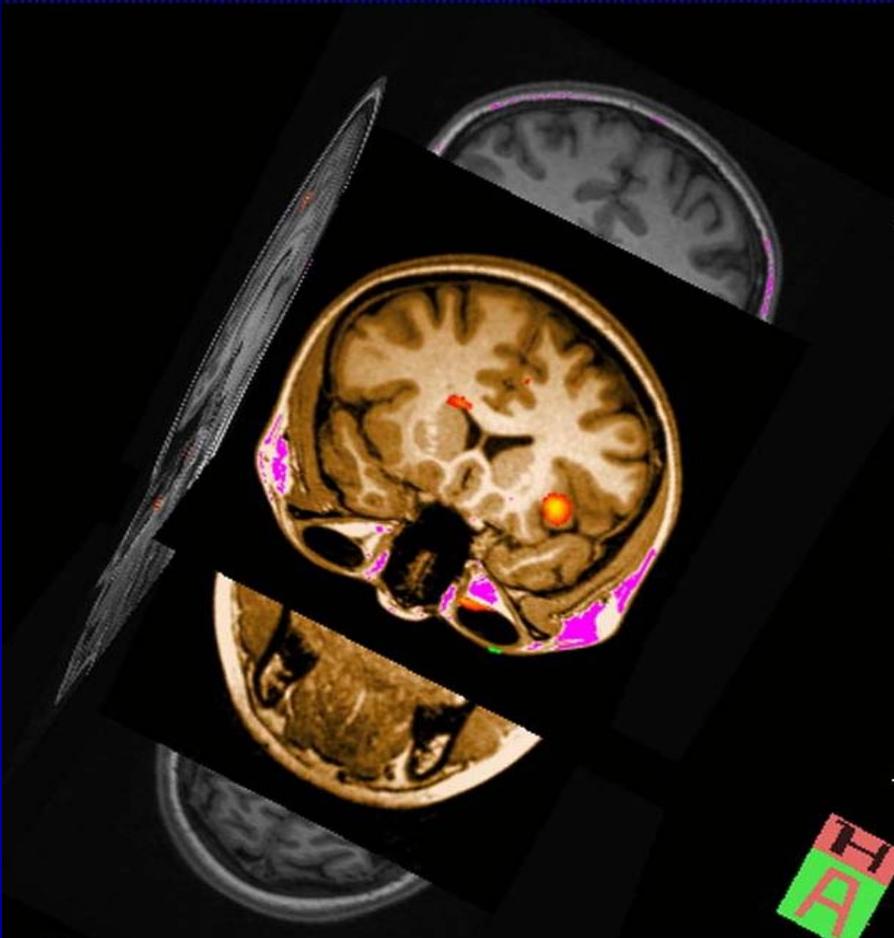
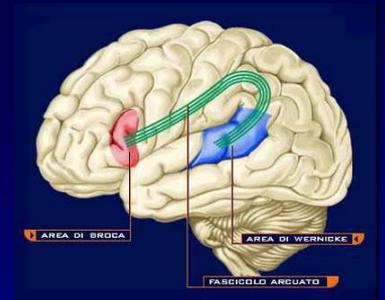
Equilibrio Hb/HbO<sub>2</sub>

A Exceso de HbO<sub>2</sub> V

Oxigenación venosa



# Área de Broca

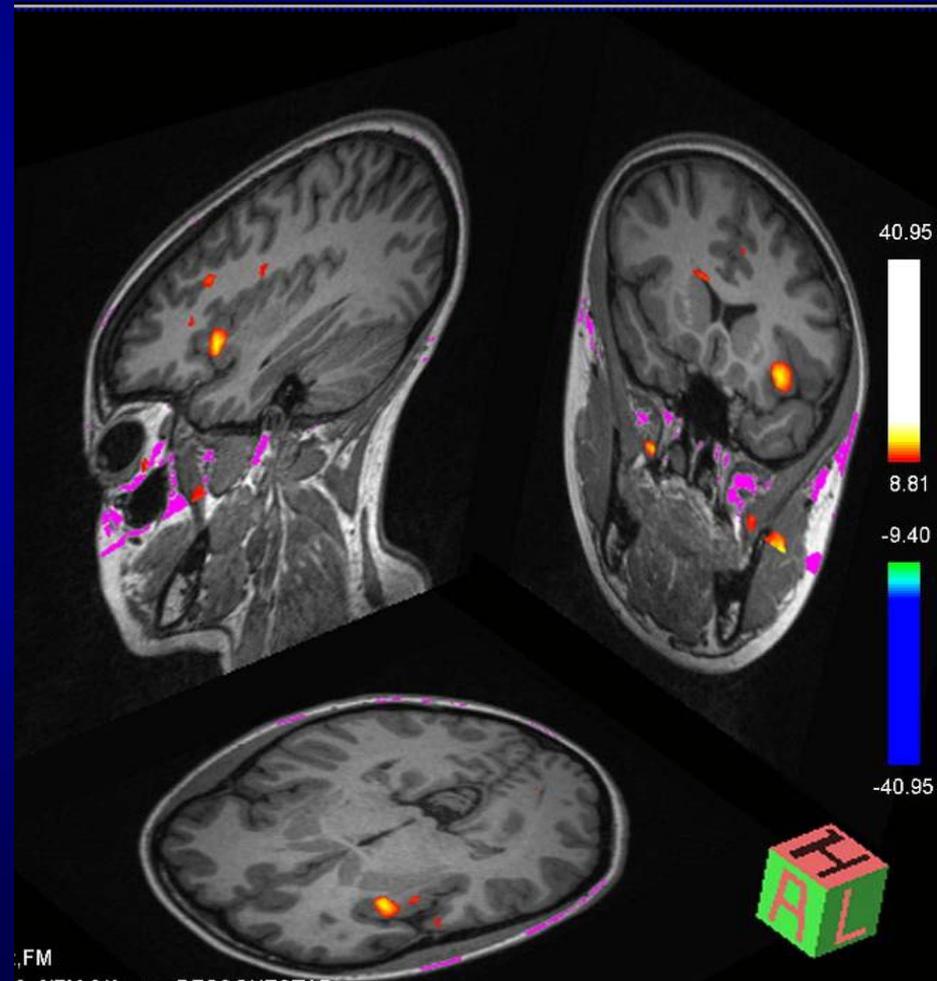


*Generación de palabras:* Activación del área de Broca en voluntaria de 26 años **diestra** tras repetición de palabras simples

A. Alonso-Burgos, J. L. Zubieta, et als

Servicio de Radiología

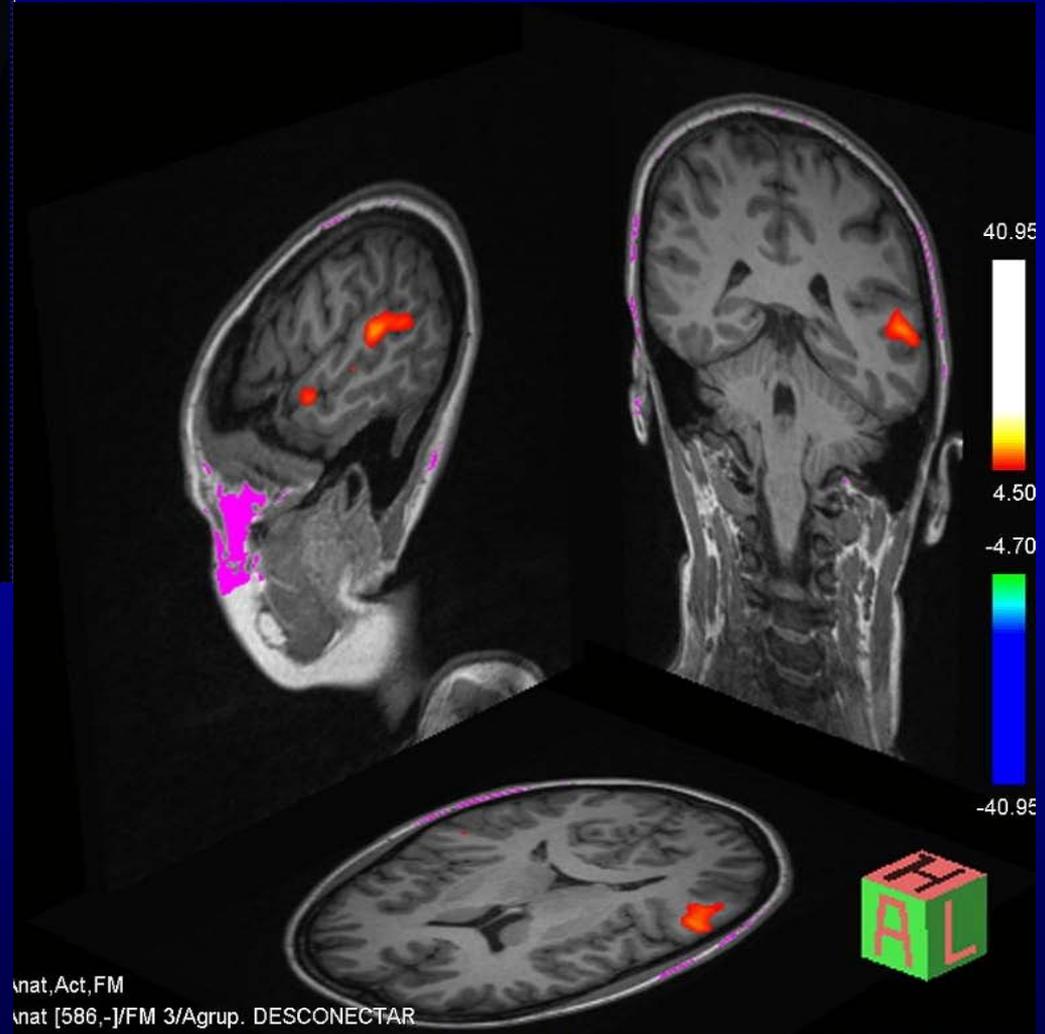
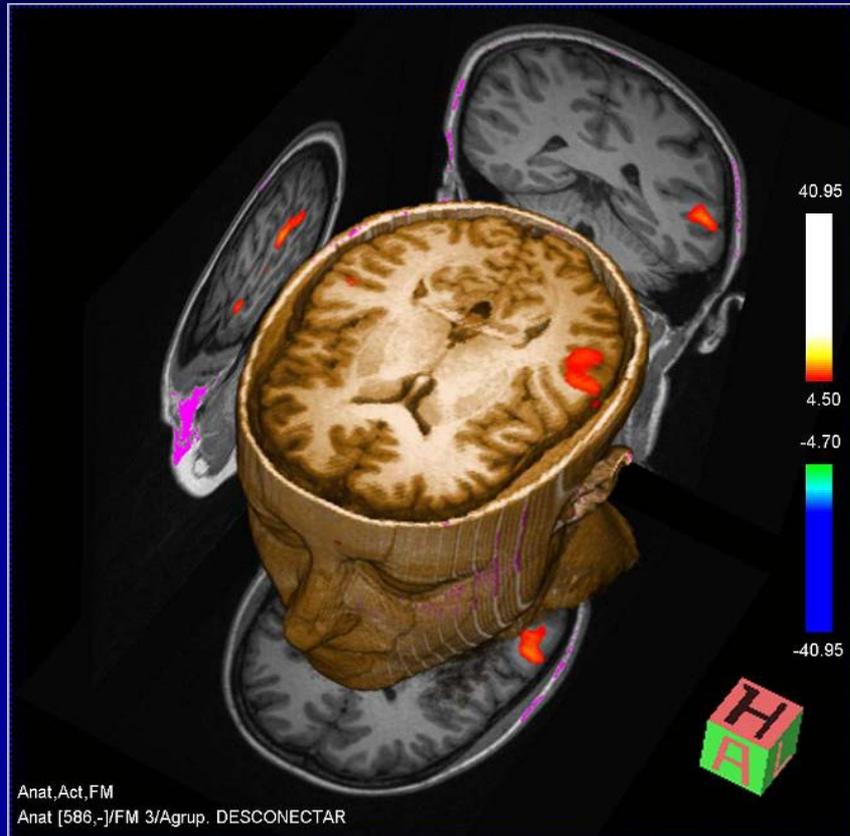
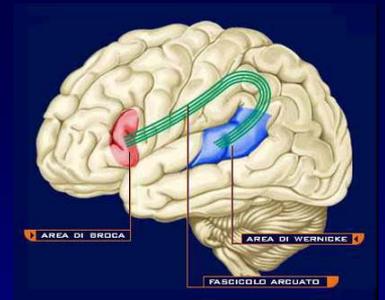
Clnica Universitaria. Universidad de Navarra



FM

6 2FM 214 2500000000

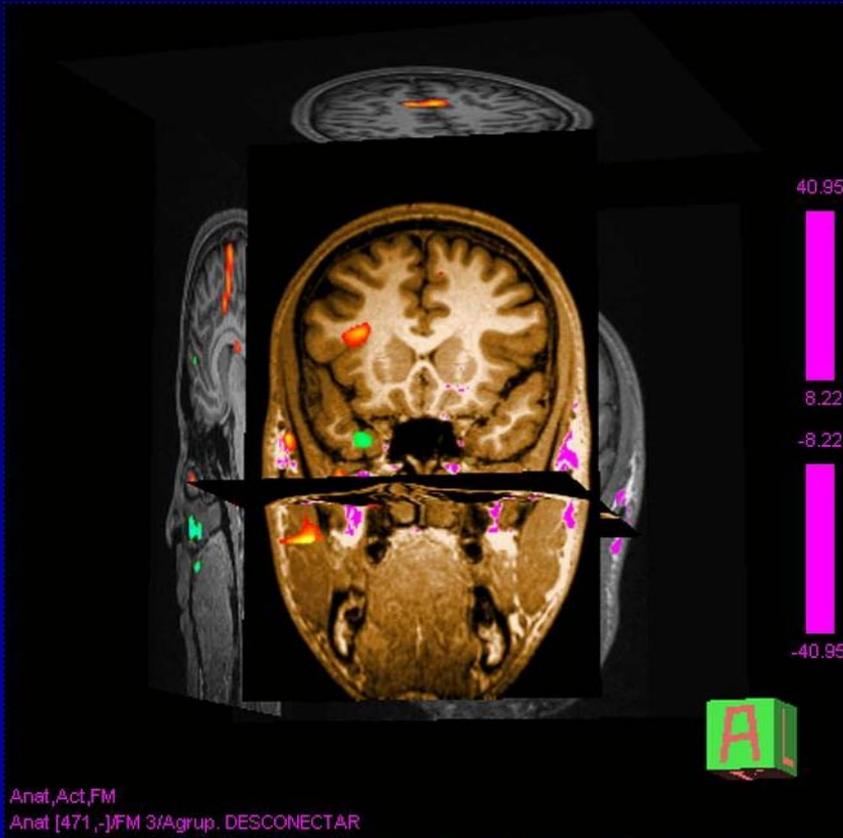
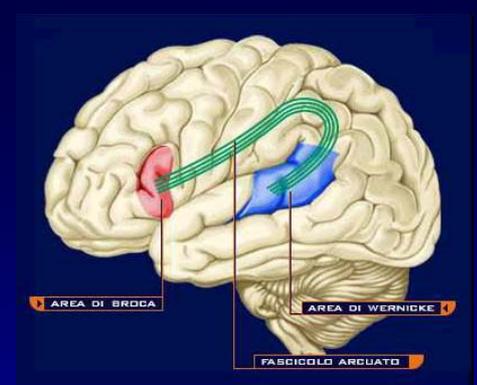
# Área de Wernicke



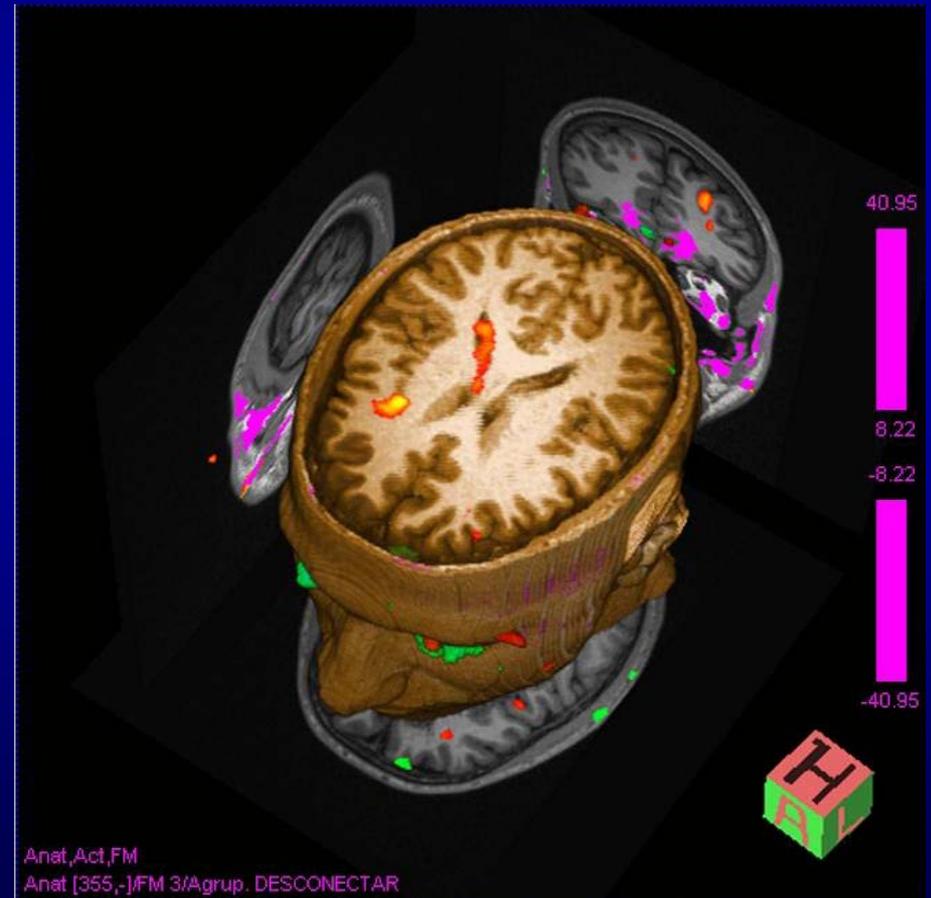
*Escucha:* Activación del área de Wernicke en voluntaria de 26 años **diestra** tras escucha de paradigma audible

A. Alonso-Burgos, J. L. Zubieta, et als  
Servicio de Radiología  
Clínica Universitaria. Universidad de Navarra

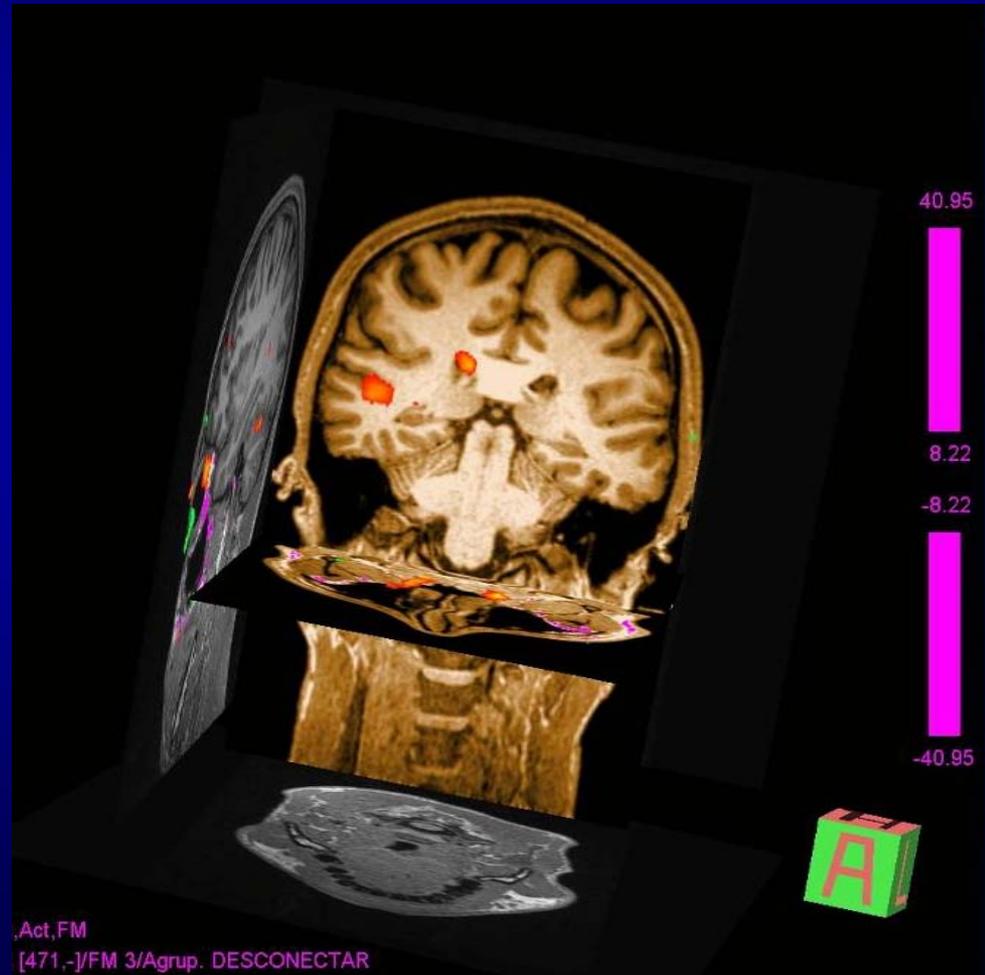
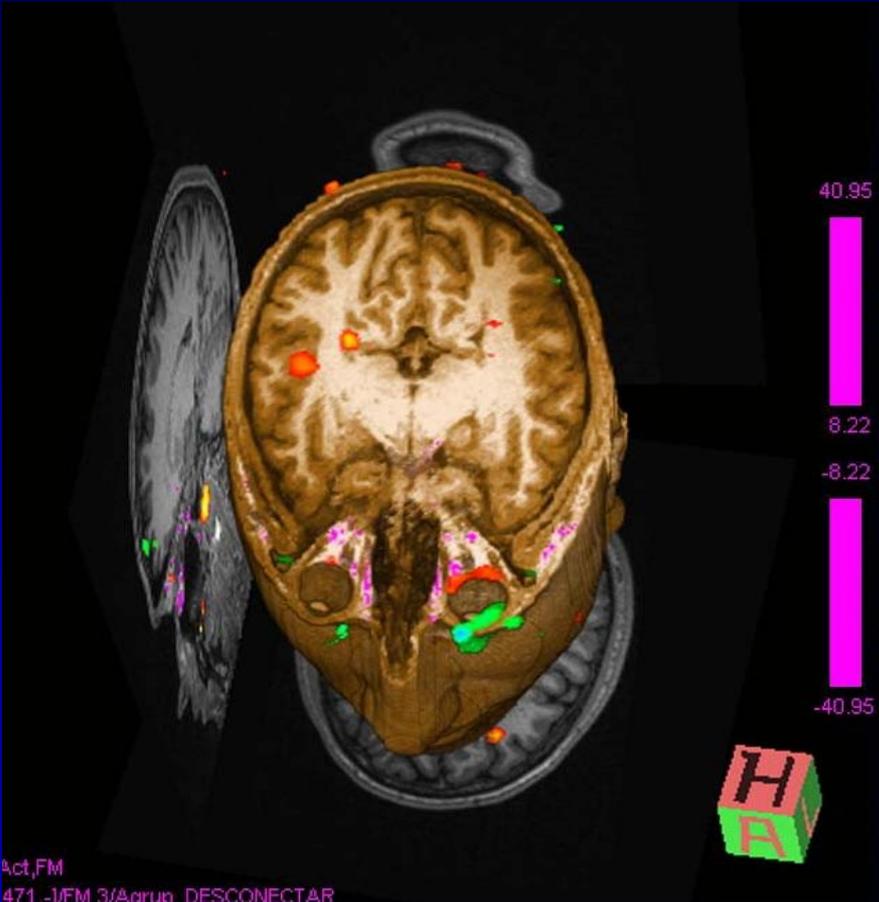
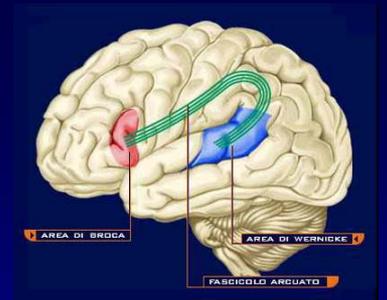
# Área de Broca



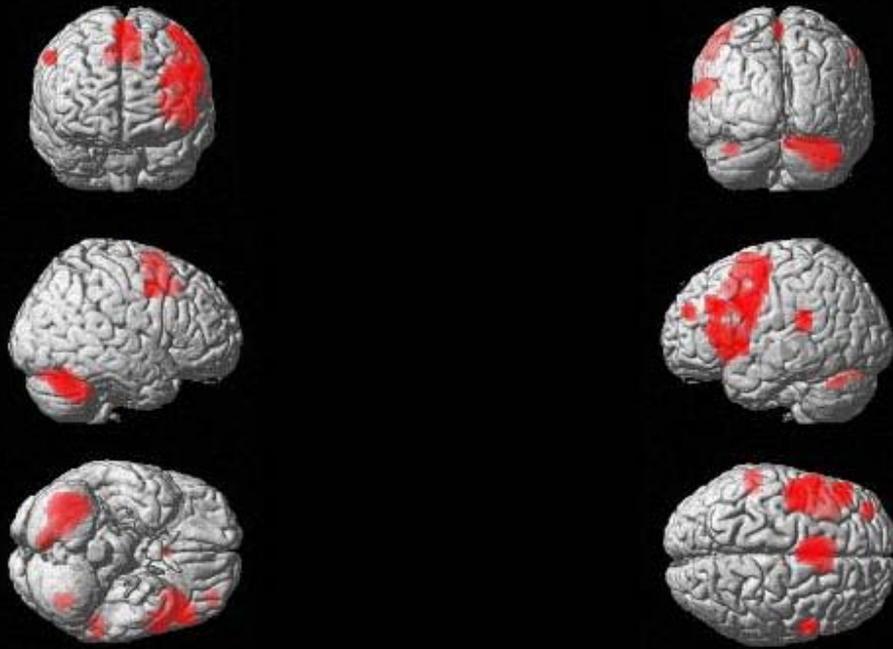
*Generación de palabras:* Activación del área de Broca en paciente (no incluido en este estudio) de 27 años, zurdo, tras repetición de palabras simples



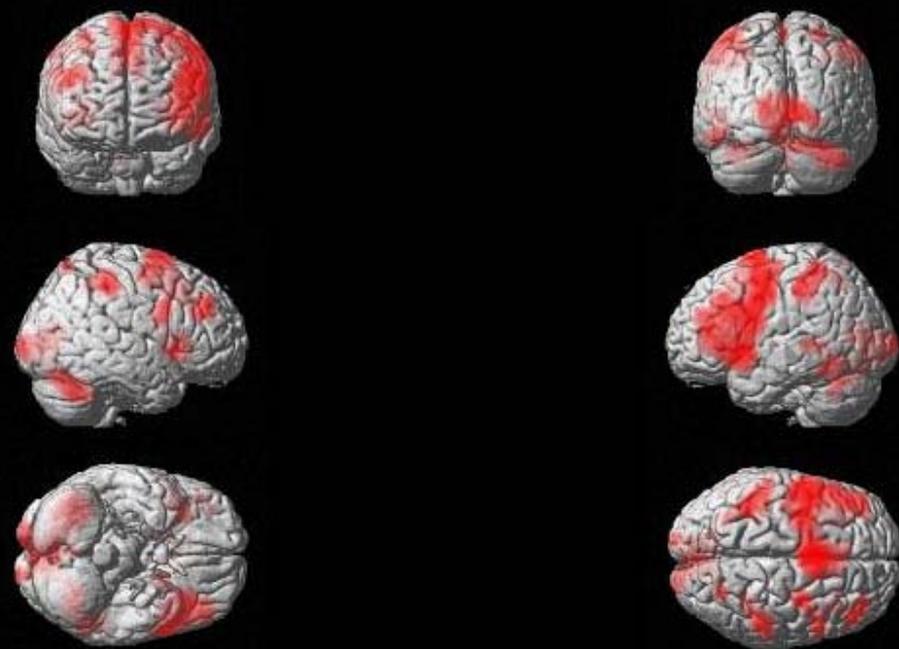
# Área de Wernicke



*Escucha:* Activación del área de Wernicke en voluntario de 27 años zurda tras escucha de paradigma audible



## Área de Broca Sujetos Diestros



## Área de Broca Sujetos Zurdos

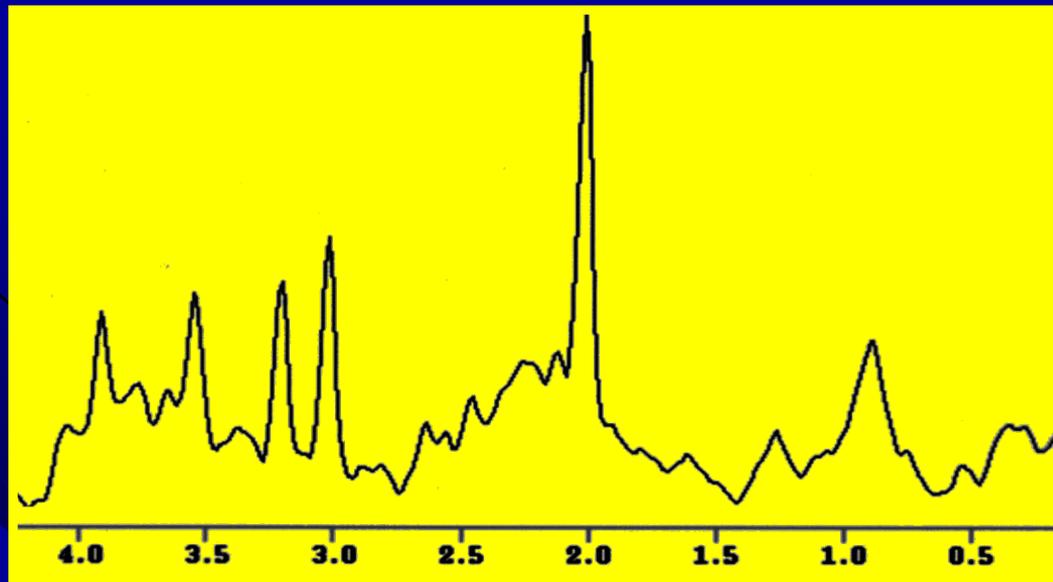
Análisis realizado en el grupo de sujetos diestros tras la realización de paradigmas de expresión.

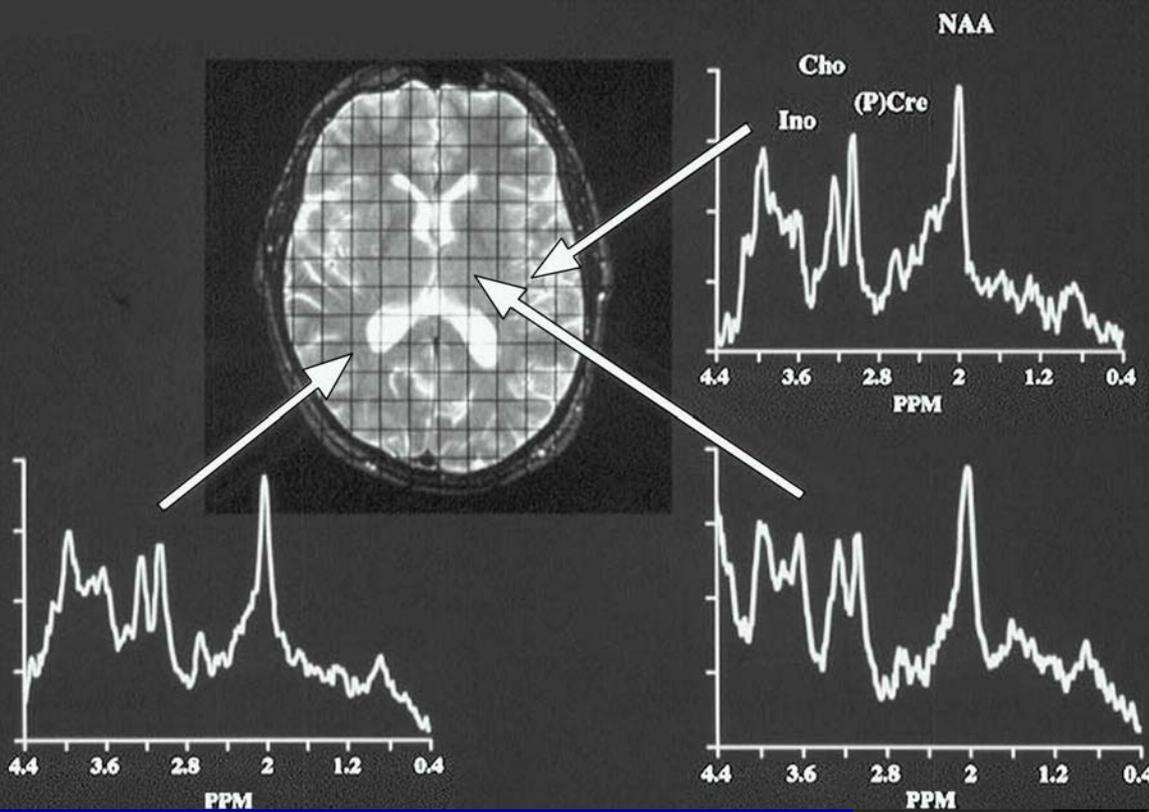
Se aprecia una activación del área suplementaria motora así como del área motora del lado izquierdo que se extiende hasta alcanzar el área de Broca, la cual también se encuentra activada.

Obsérvese también una activación del cerebelo contralateral.

# Espectroscopía por Resonancia Magnética

**Espectro** → distribución de intensidades de energía absorbida o emitida. Contiene información acerca de las propiedades físicas y químicas de la muestra

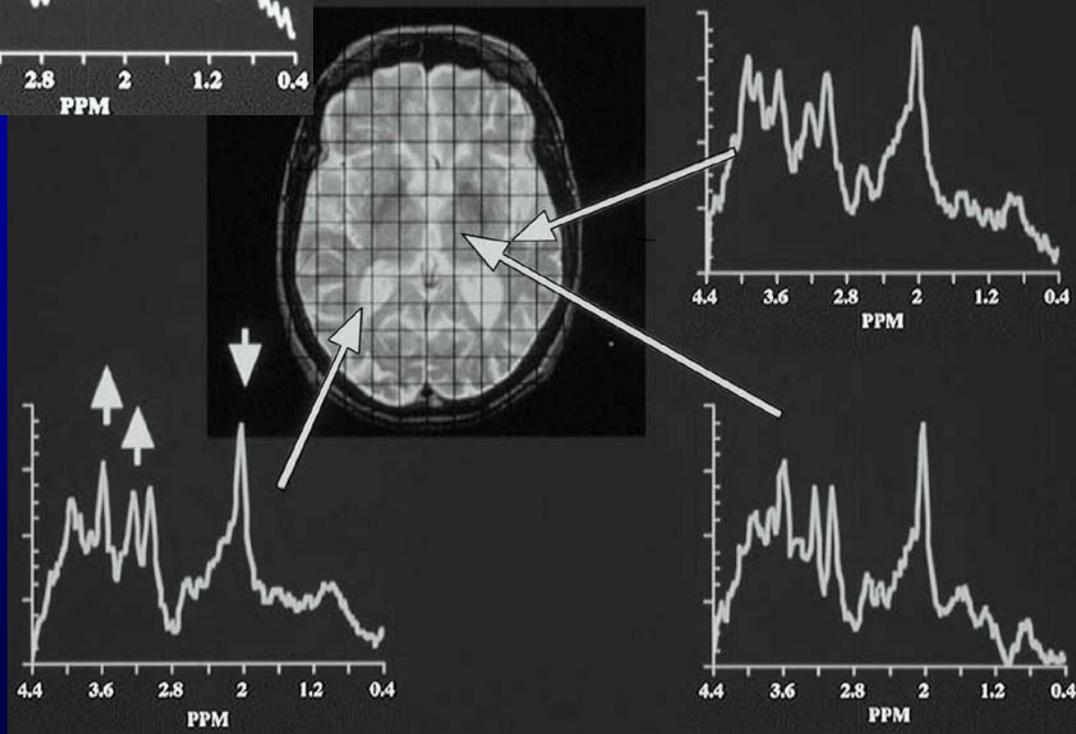




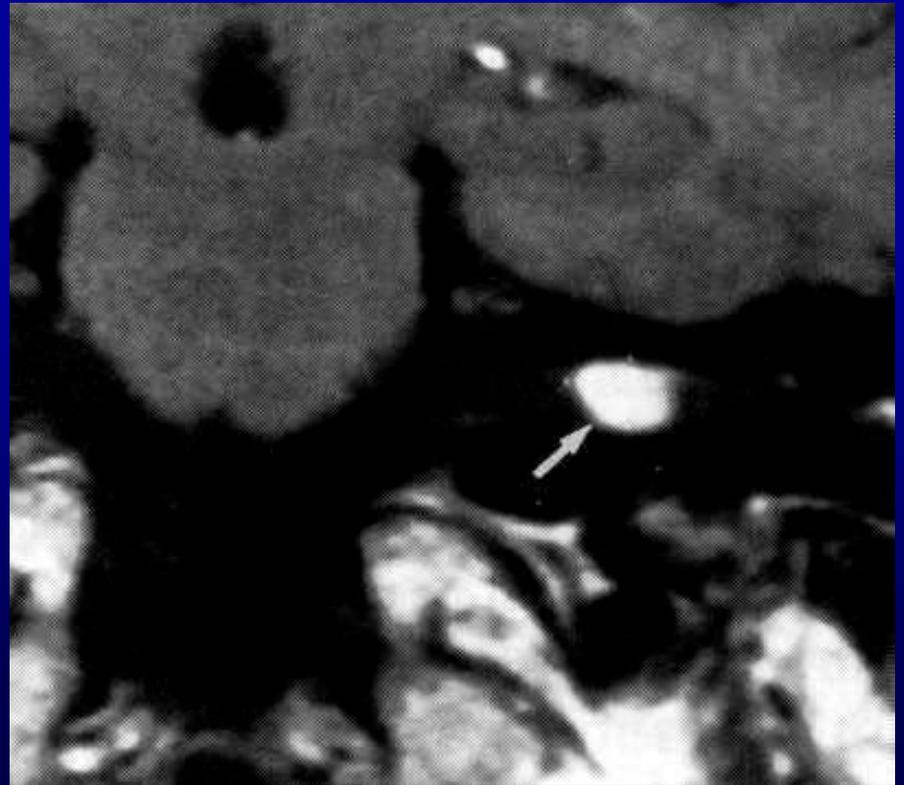
Varón 80 años Alzheimer  
 → aumento mio-inositol y colina  
 → disminución NAA

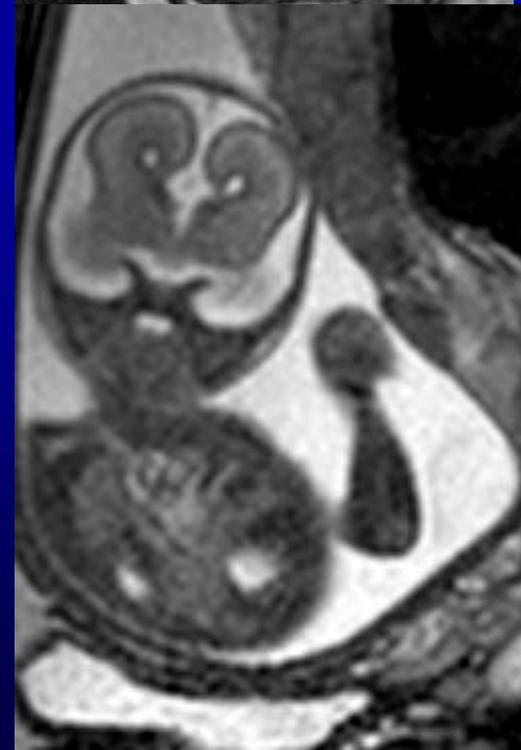
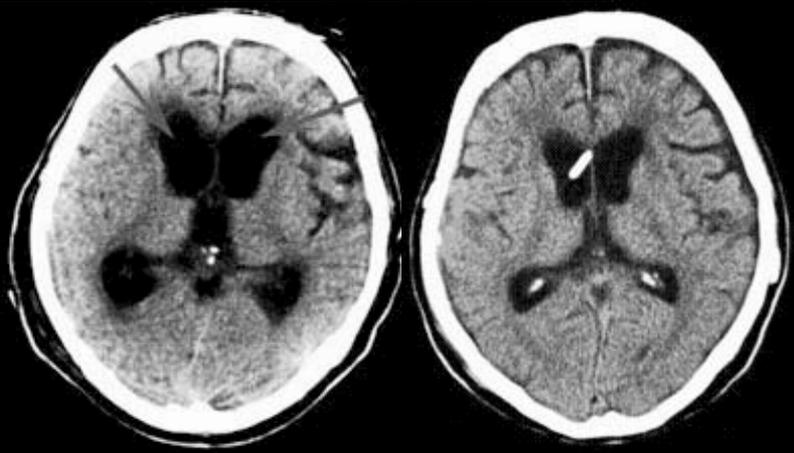
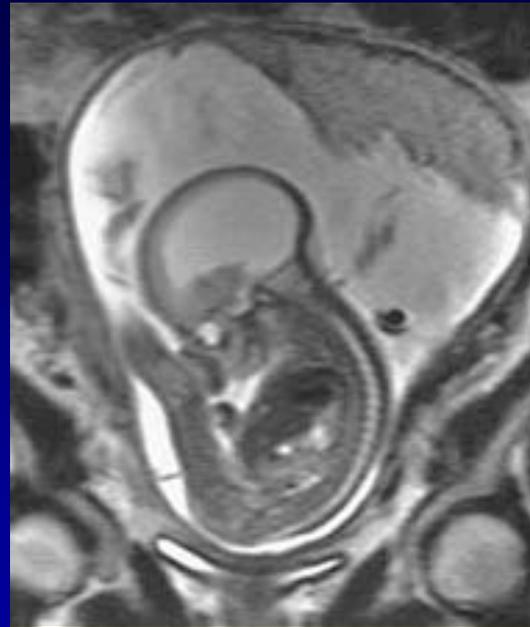
Varón 62 años sano

Espectroscopia multivoxel



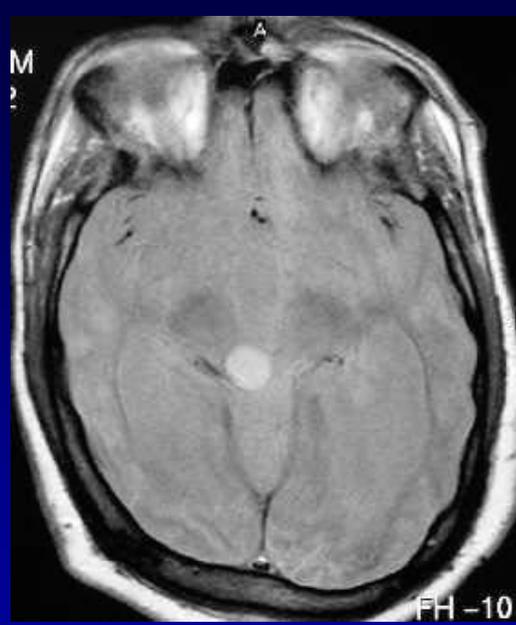




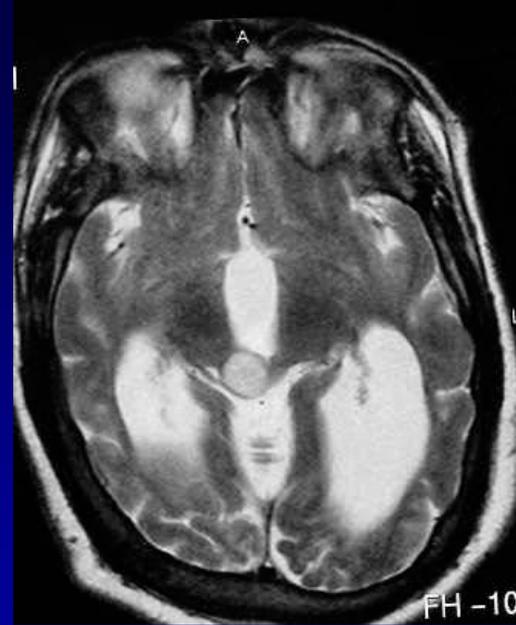




16-Agosto-1988

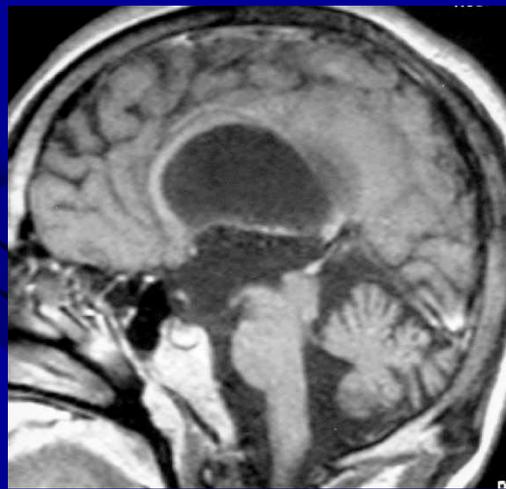


FH-10

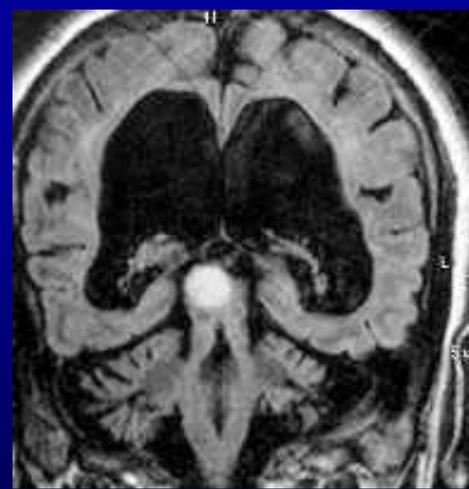


FH-10

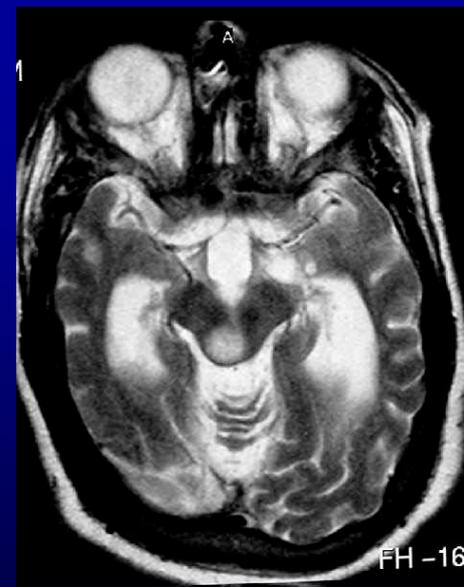
FN 14-Julio-75



Seguimientos lesionales



1995

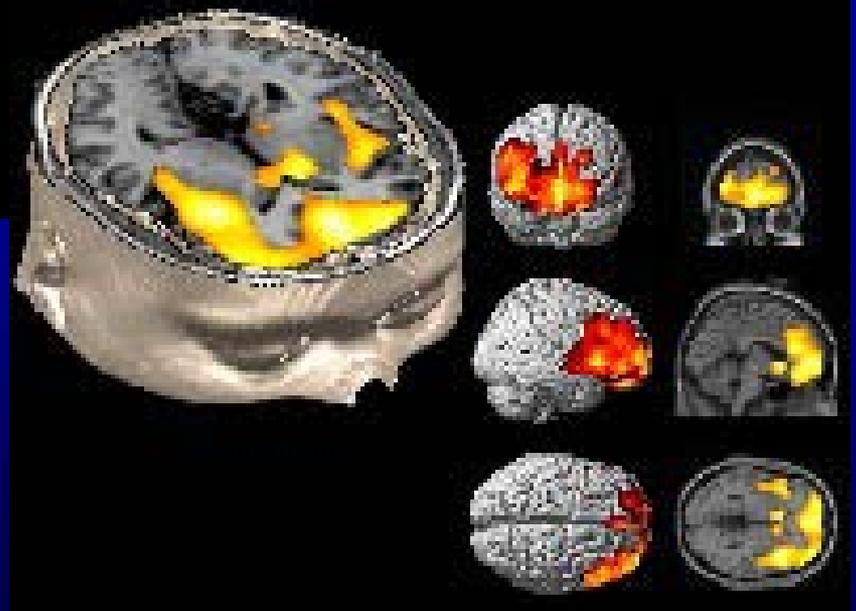


FH-16



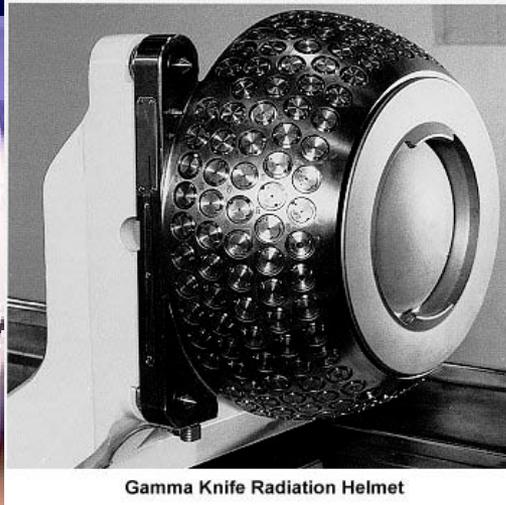
Cuantificación estudios  
RM/PET en esquizofrenia

Integración de técnicas

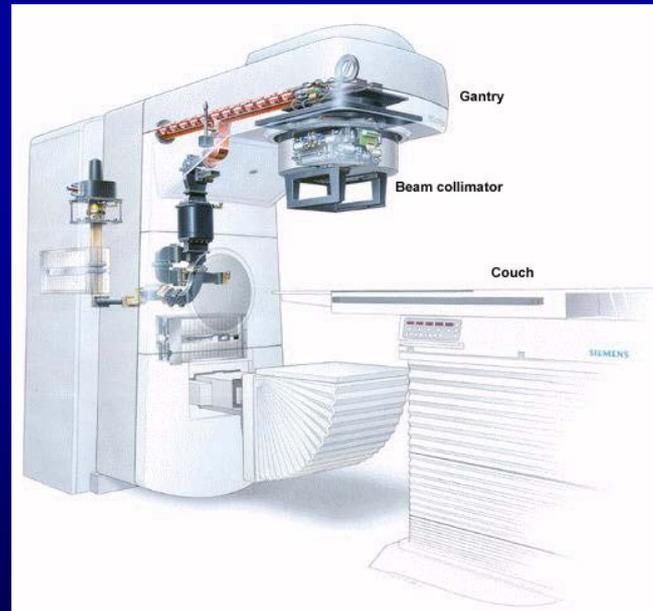




**Realidad virtual**

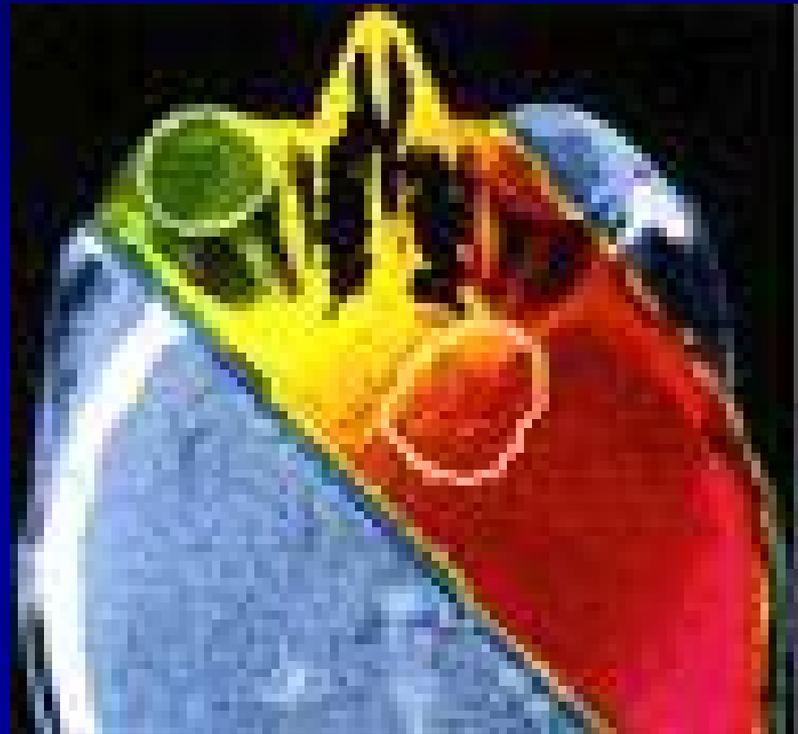


## Gamma Knife (Cobalto 60)

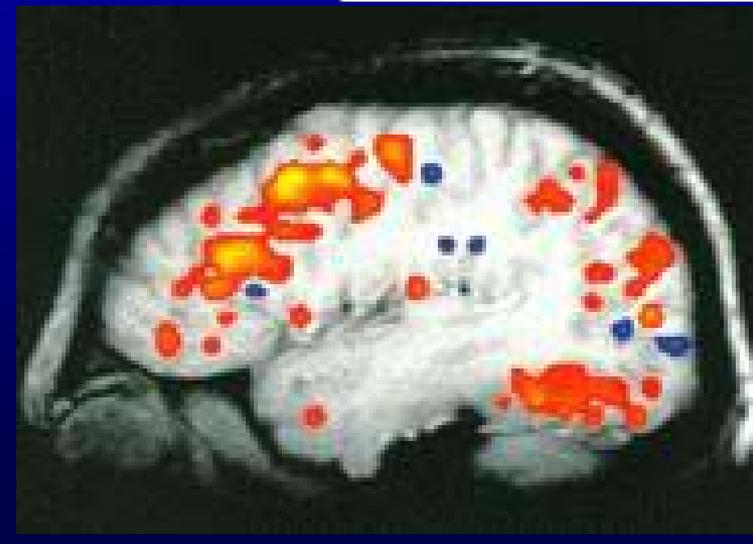
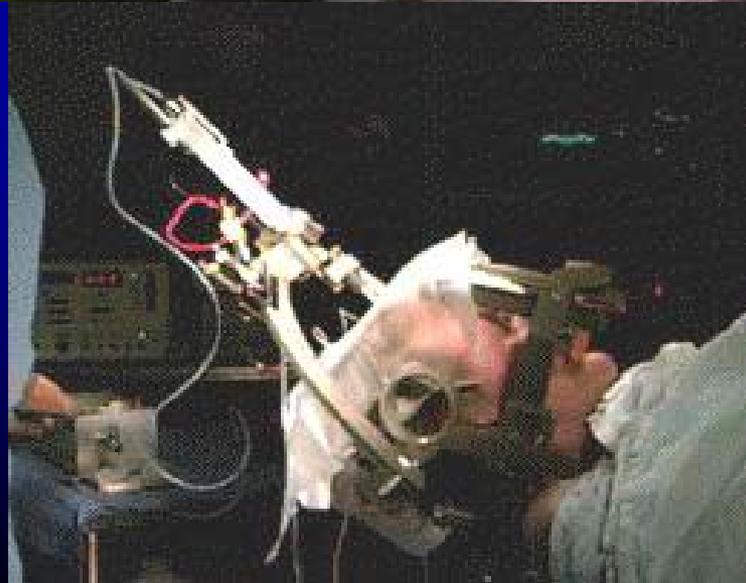
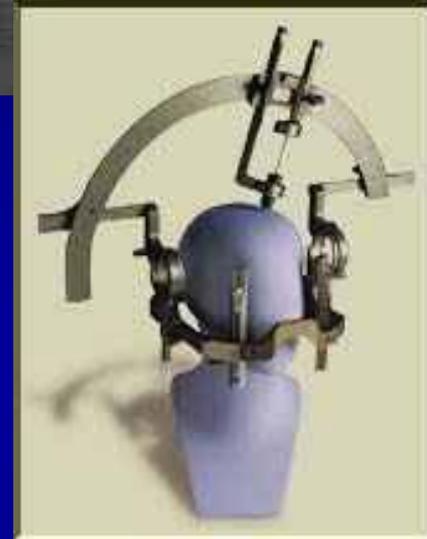


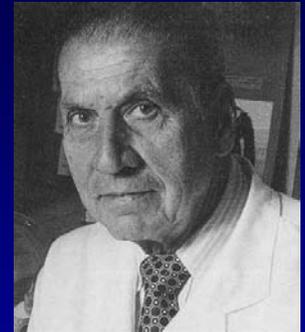
**Radiocirugía**

**Acelerador lineal "LINAC"  
radiación gamma**



# Psicocirugía





## MIND CONTROL

José Delgado Controls An Angry Bull  
by Electrical Stimulation of the Brain

*New York Times* 17 May 1965

José Manuel Rodríguez Delgado

Director of Neuropsychiatry at Yale University Medical School





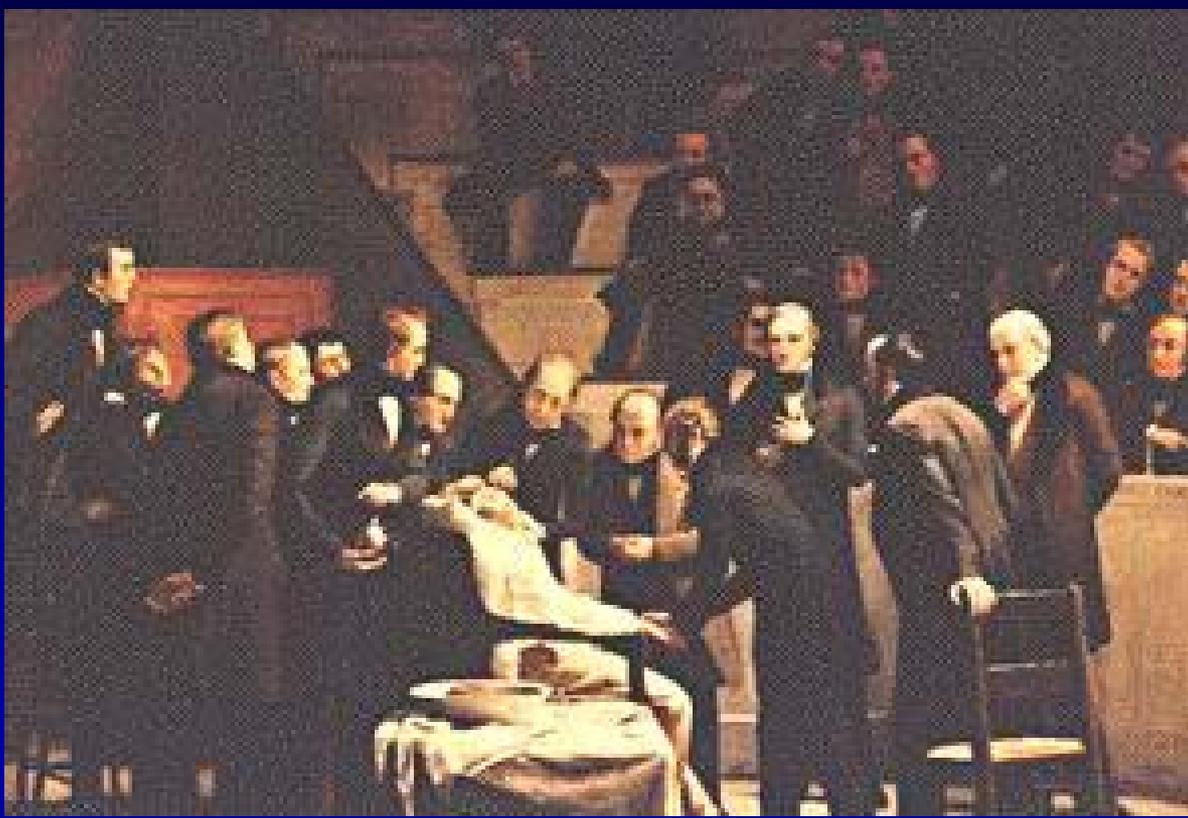


Perú

Démonstration:  
Affichage d'un scan de cerveau sur  
tête réelle et manipulation du contenu.

Demonstration:  
Display of a brain scan on a  
real head and contents manipulations.

Realidad aumentada



He pretendido reflejar los cambios en el conocimiento, en las actitudes clínicas y diagnósticas, así como en las posibilidades terapéuticas que los progresos técnicos nos han permitido en la visualización y obtención de imágenes tanto de la normalidad como de los procesos patológicos.