



VIII Congresso Regional de Histotecnologia
IBILCE/UNESP – São José do Rio Preto – SP

MICROSCOPIA, MESOSCOPIA E MACROSCOPIA EM NEUROANATOMIA

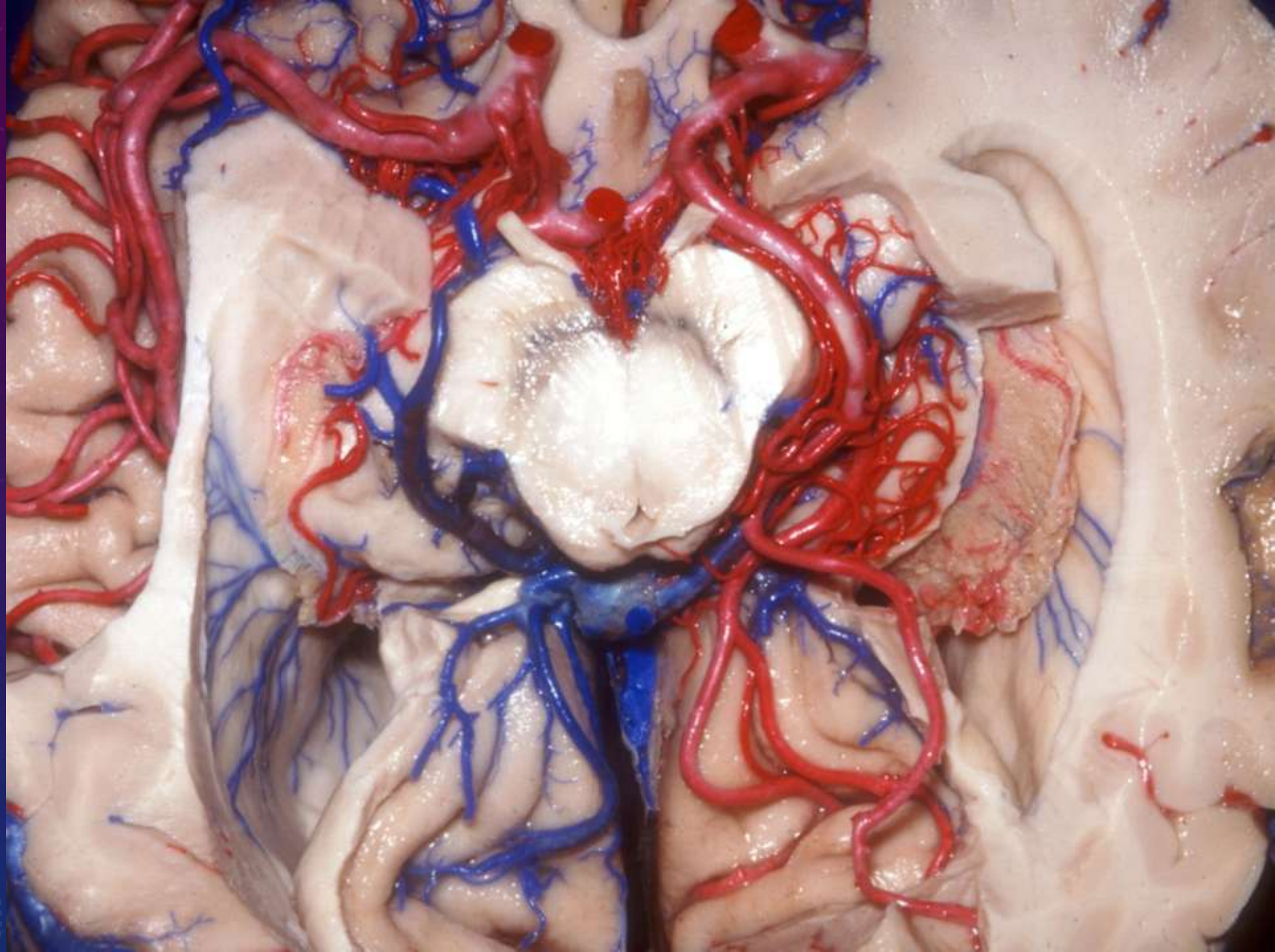
PROF. DR. MARCUS ALEXANDRE MENDES LUZ

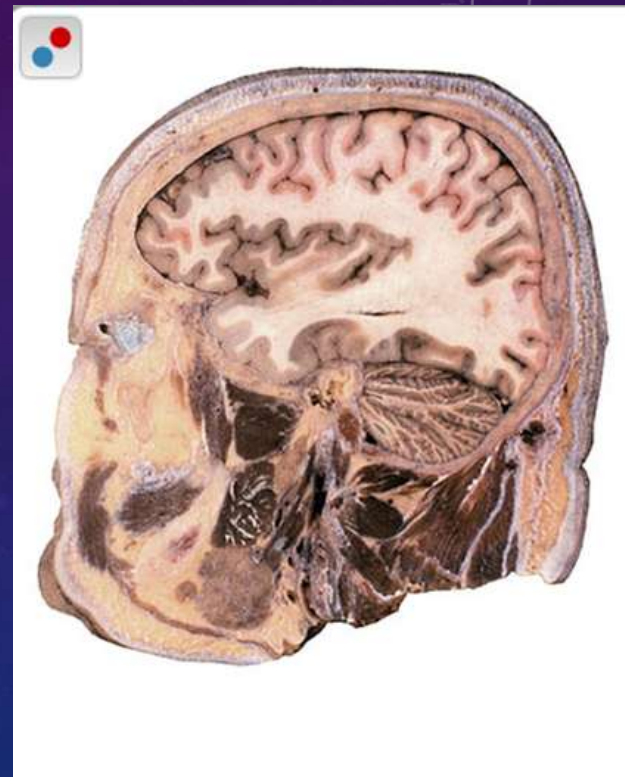
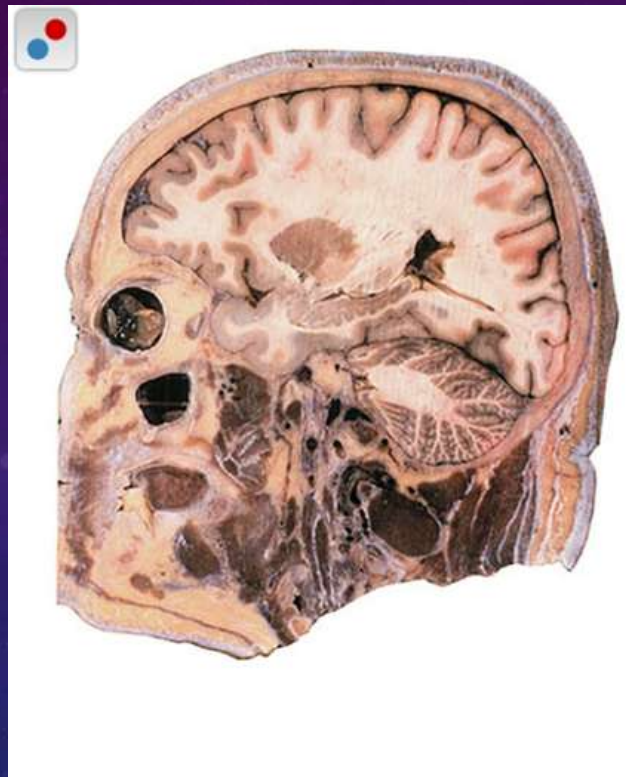
ANATOMIA HUMANA E ANATOMIA PATOLÓGICA
FACULDADE DE MEDICINA - UNILAGO

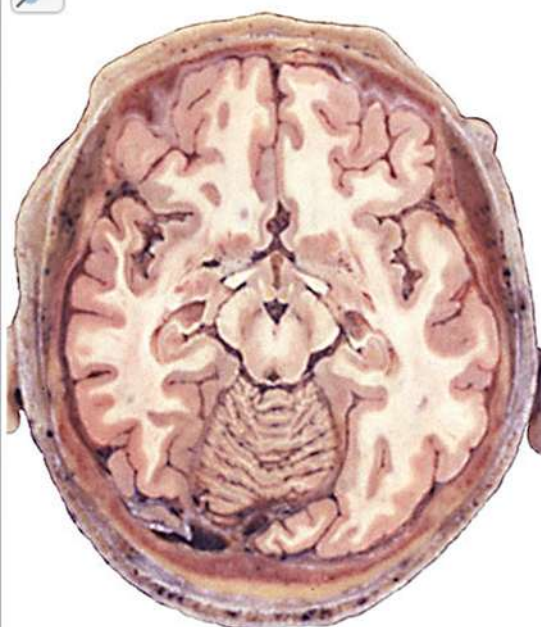
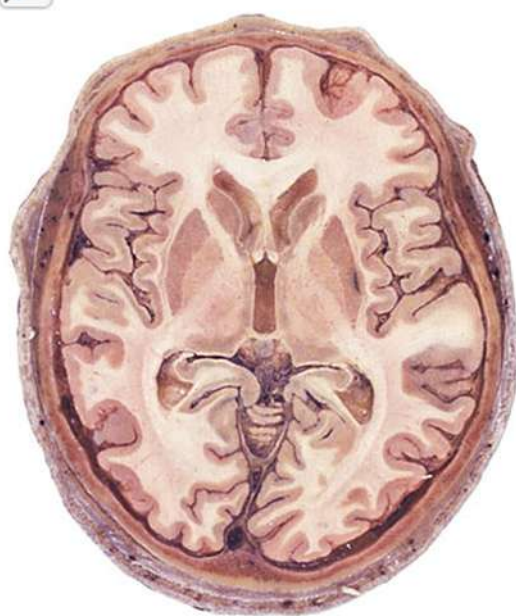
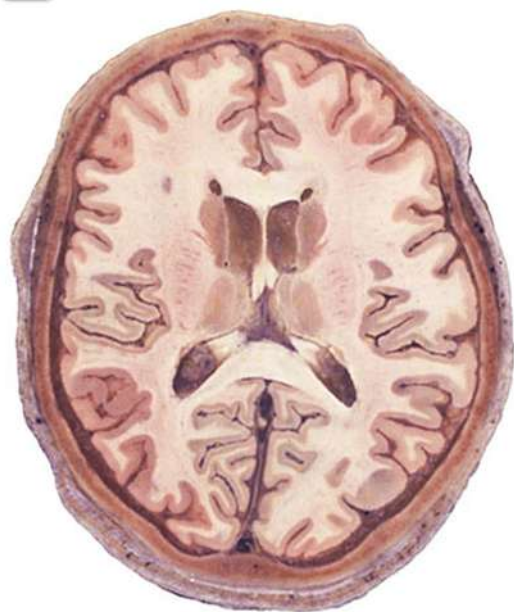
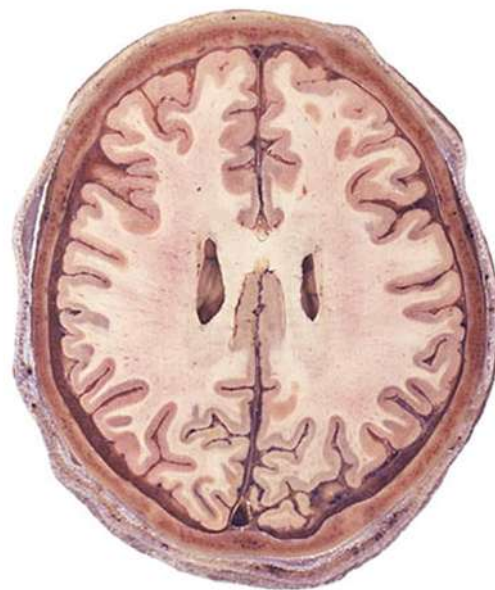
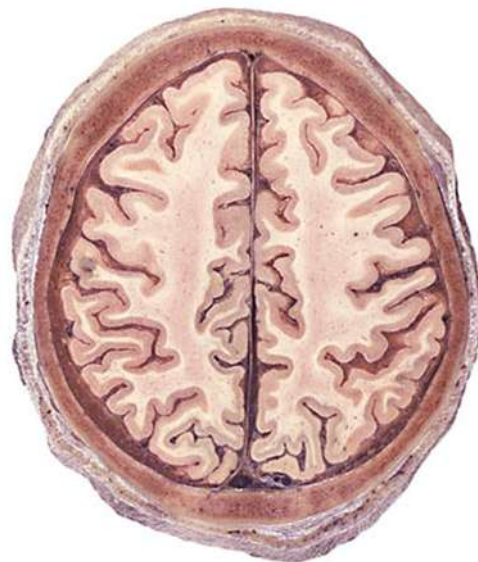
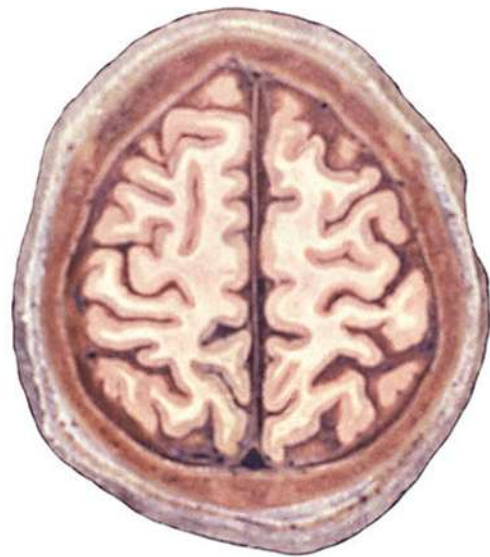
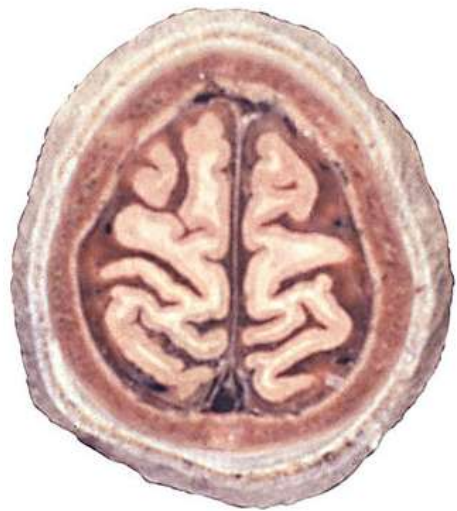


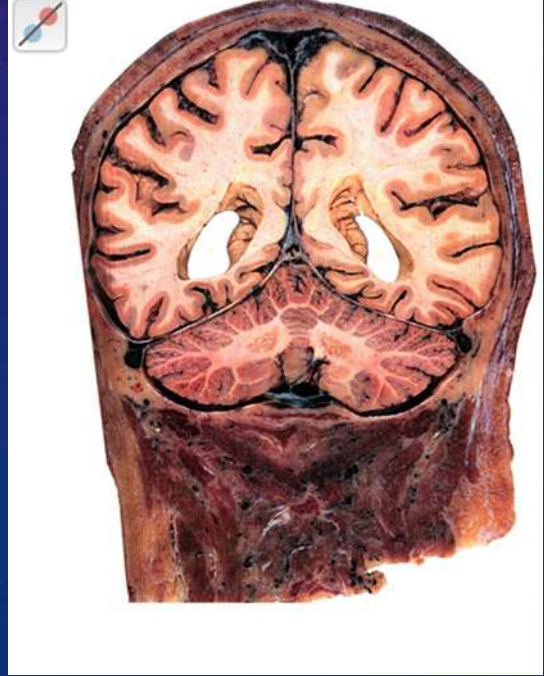




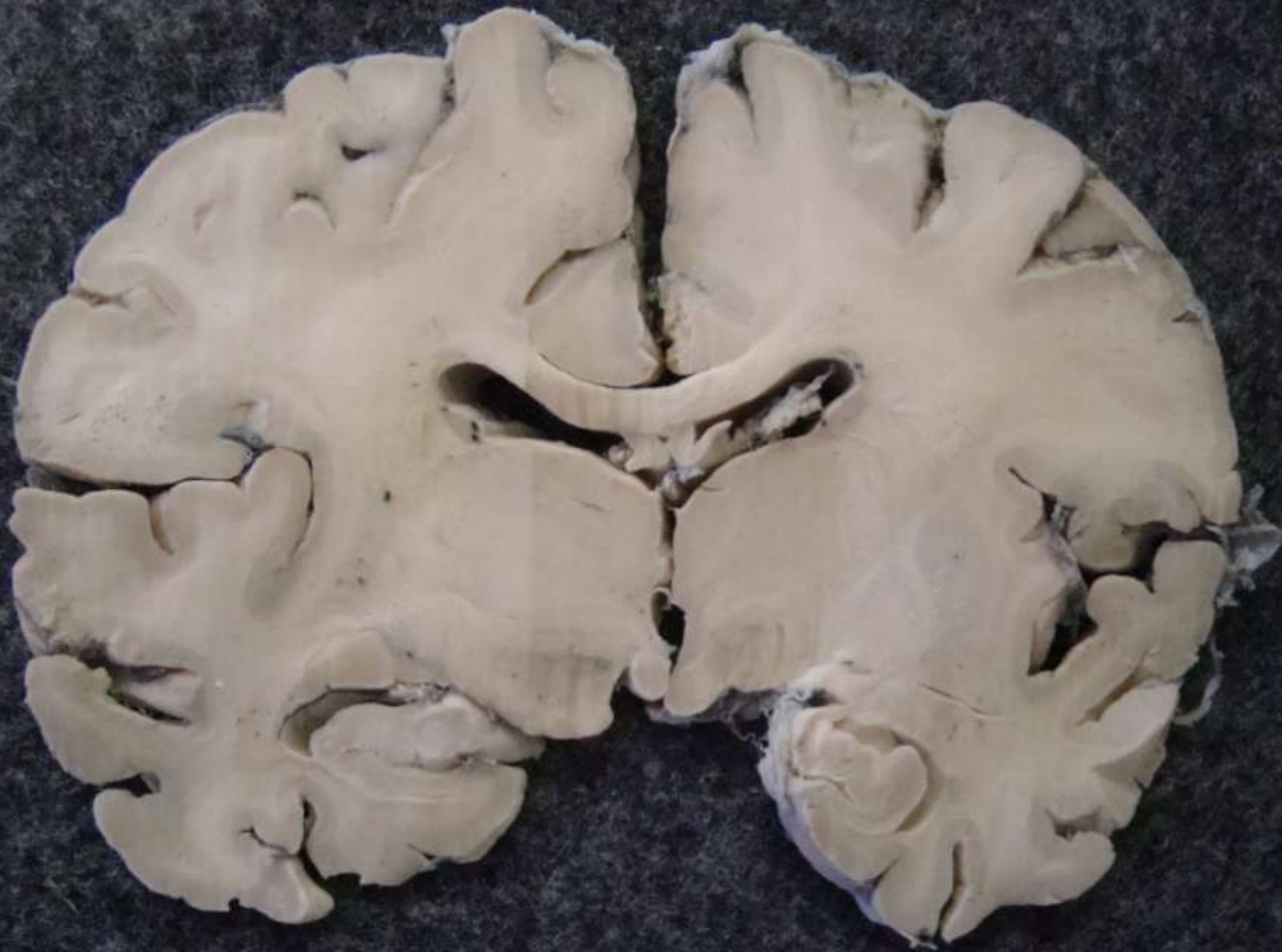












- **Barnard – Robert – Brown**
(Rodrigues, H., 2005)

Le Masurier

Formol 10%

Solução de Mulligan (Sulfato de cobre)

Solução de Cloreto férrico 1%

Solução de Ferrocianeto de potássio 1%

Preservação em Solução ácida de formol 10%

Resultados: Substância branca, branco; substância cinzenta, azul turquesa.

*Mulligan JH. A method of staining for macroscopic study. J Anat London, 65:472-476, 1931.



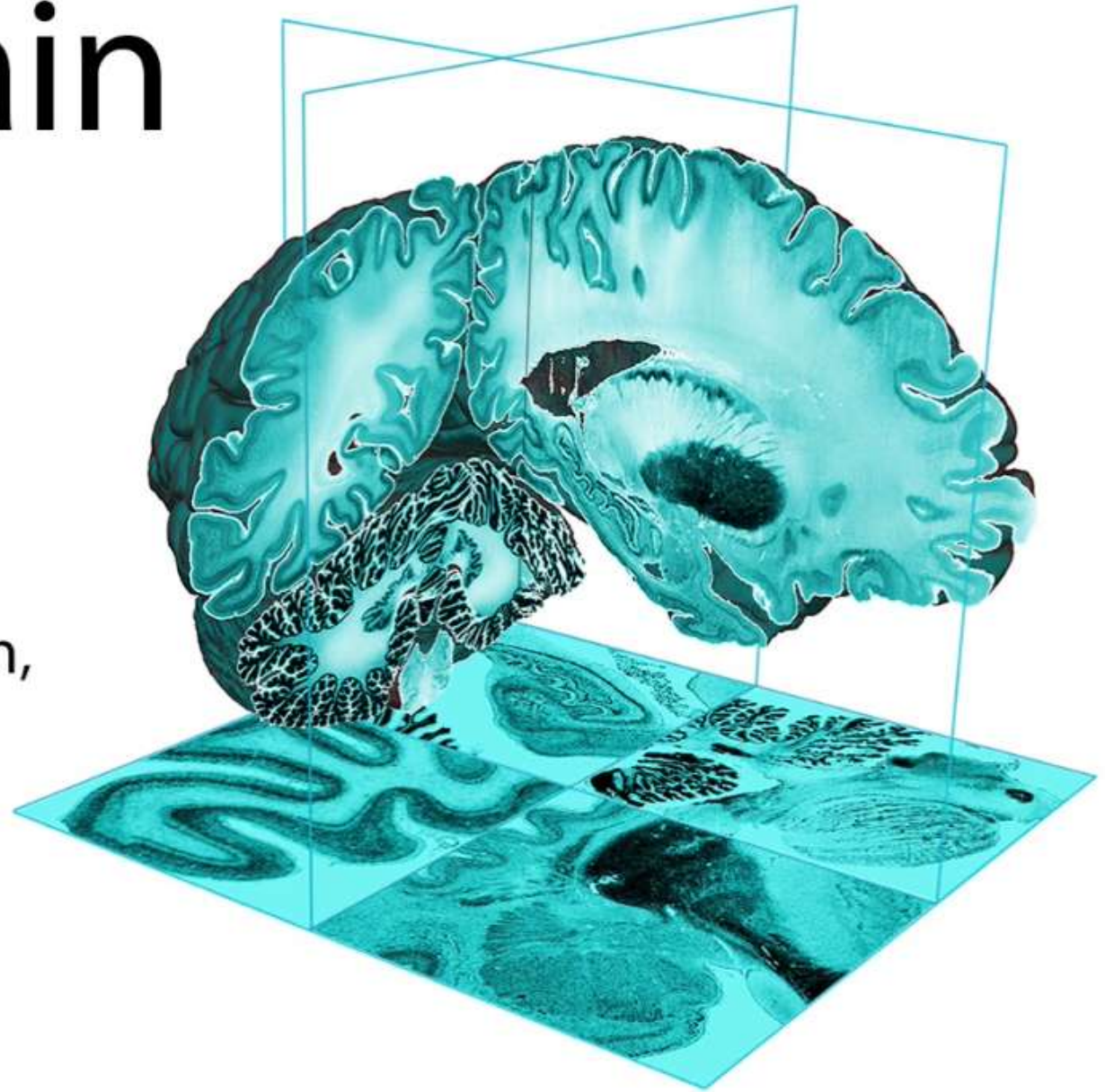
Fig 1. Foto de corte encefálico coronal passando pela comissura anterior, submetido a coloração de Barnard, Robert e Brown.





The BigBrain

- 65-year-old male
- 7,404 20- μm -thick coronal sections
- 10x10 μm^2 in-plane resolution, downsampled to 20 μm^3 isotropic resolution
- ~1 Tbyte storage



BigBrain: An Ultrahigh-Resolution 3D Human Brain Model

Katrin Amunts, Claude Lepage, Louis Borgeat, Hartmut Mohlberg, Timo Dickscheid, Marc-Étienne Rousseau, Sebastian Bludau, Pierre-Louis Bazin, Lindsay B. Lewis, Ana-Maria Oros-Peusquens, Nadim J. Shah, Thomas Lippert, Karl Zilles, Alan C. Evans.

Science, v. 340, pp. 1472-1475, 2013

Sectioning with Microtome



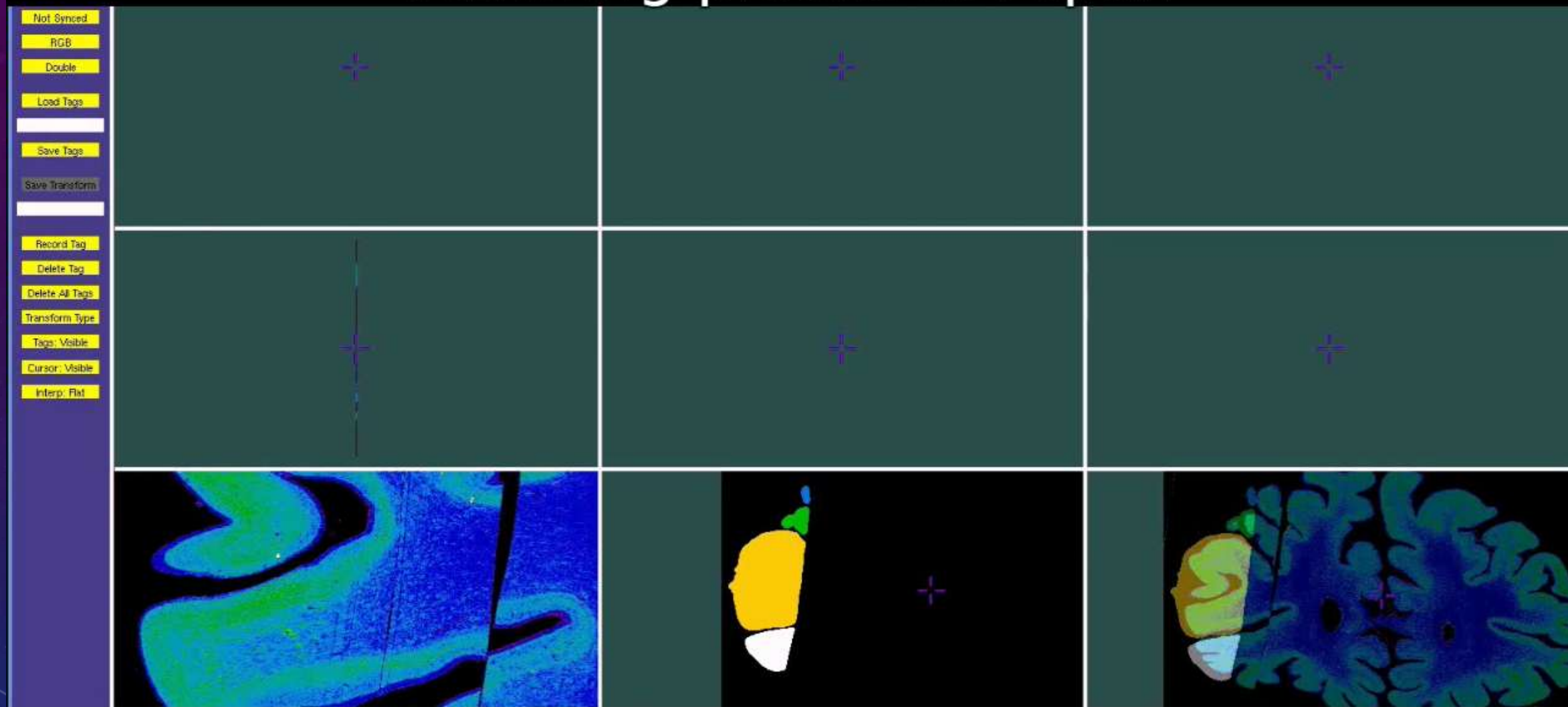


Sectioning with Microtome

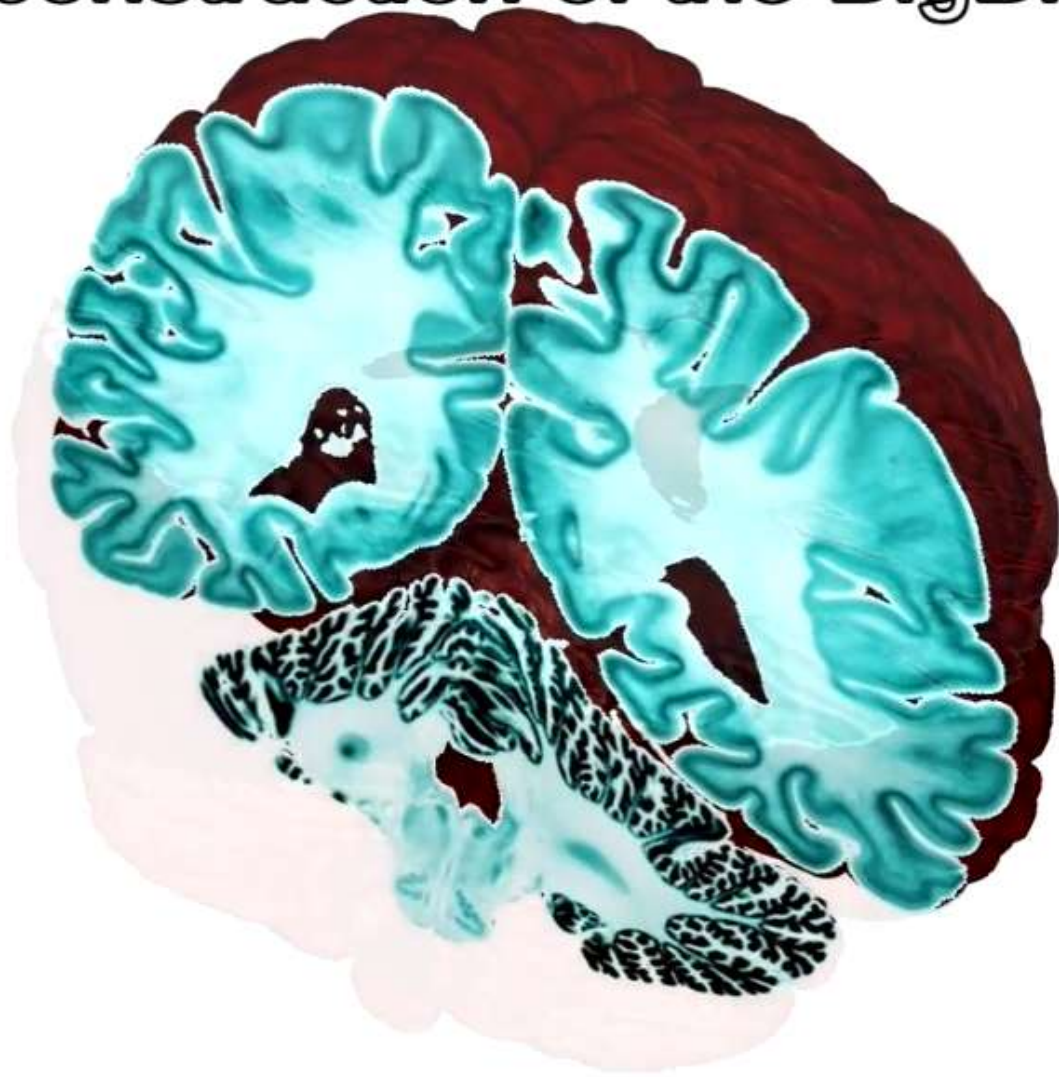


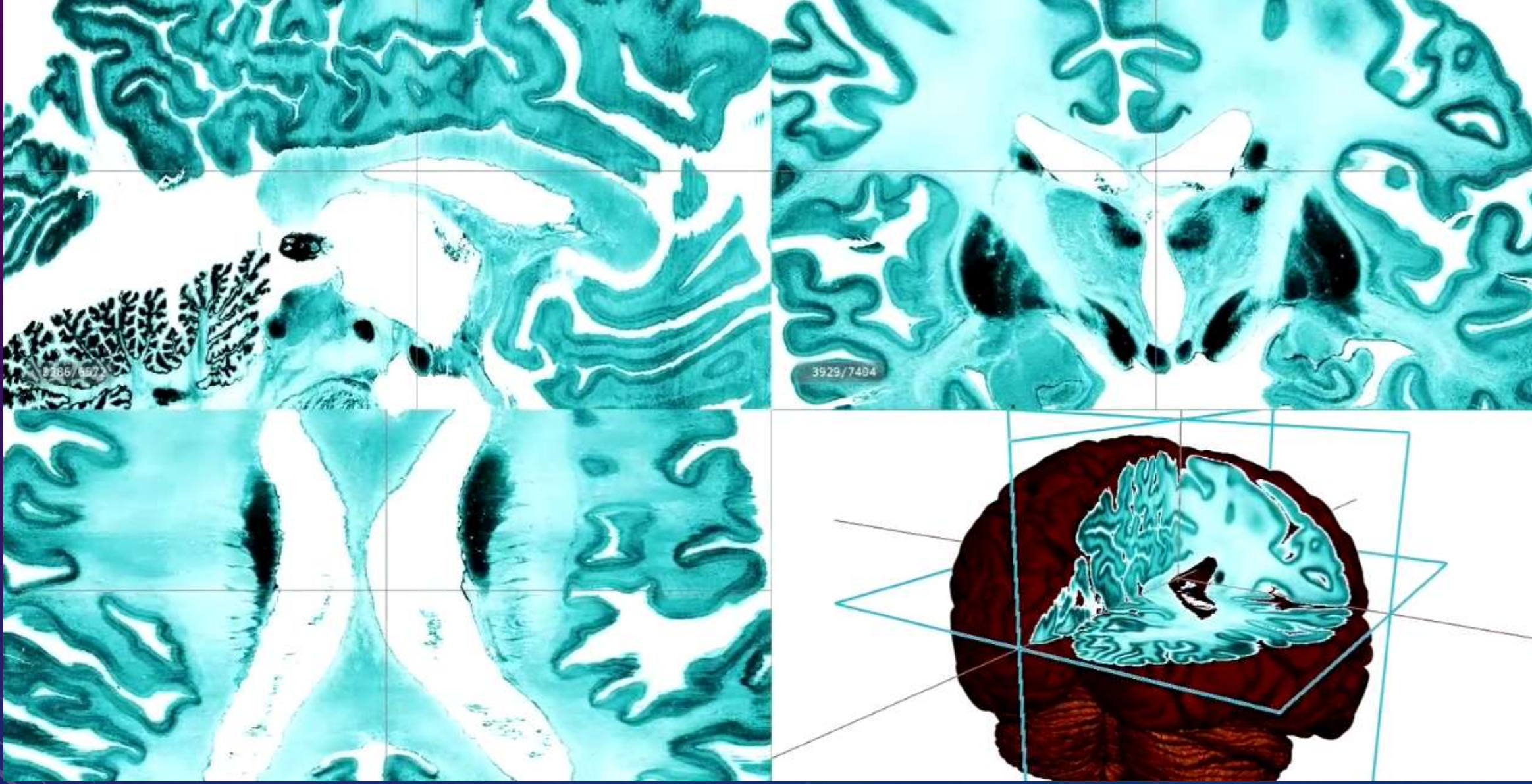


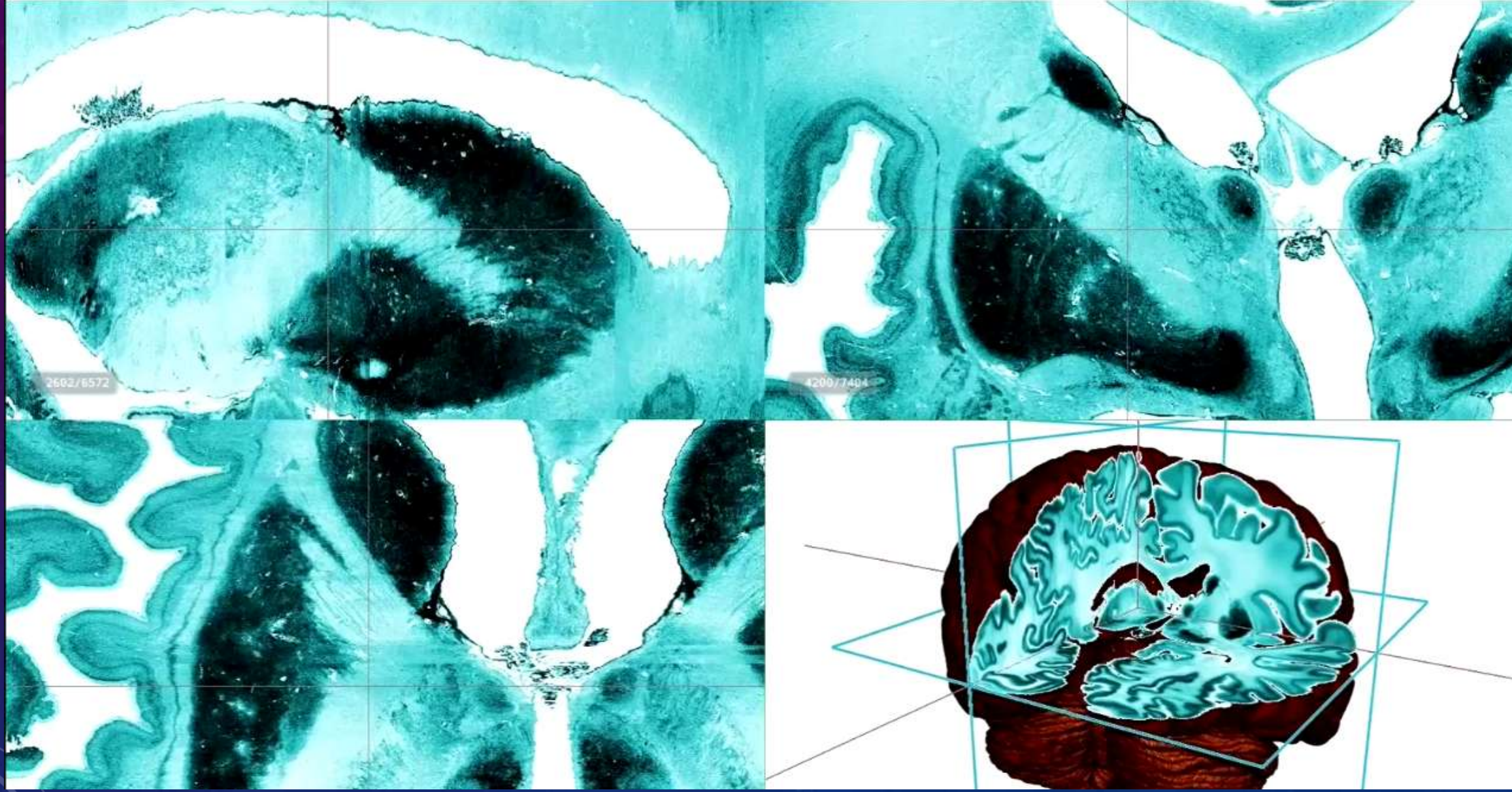
Stitching pieces to repair

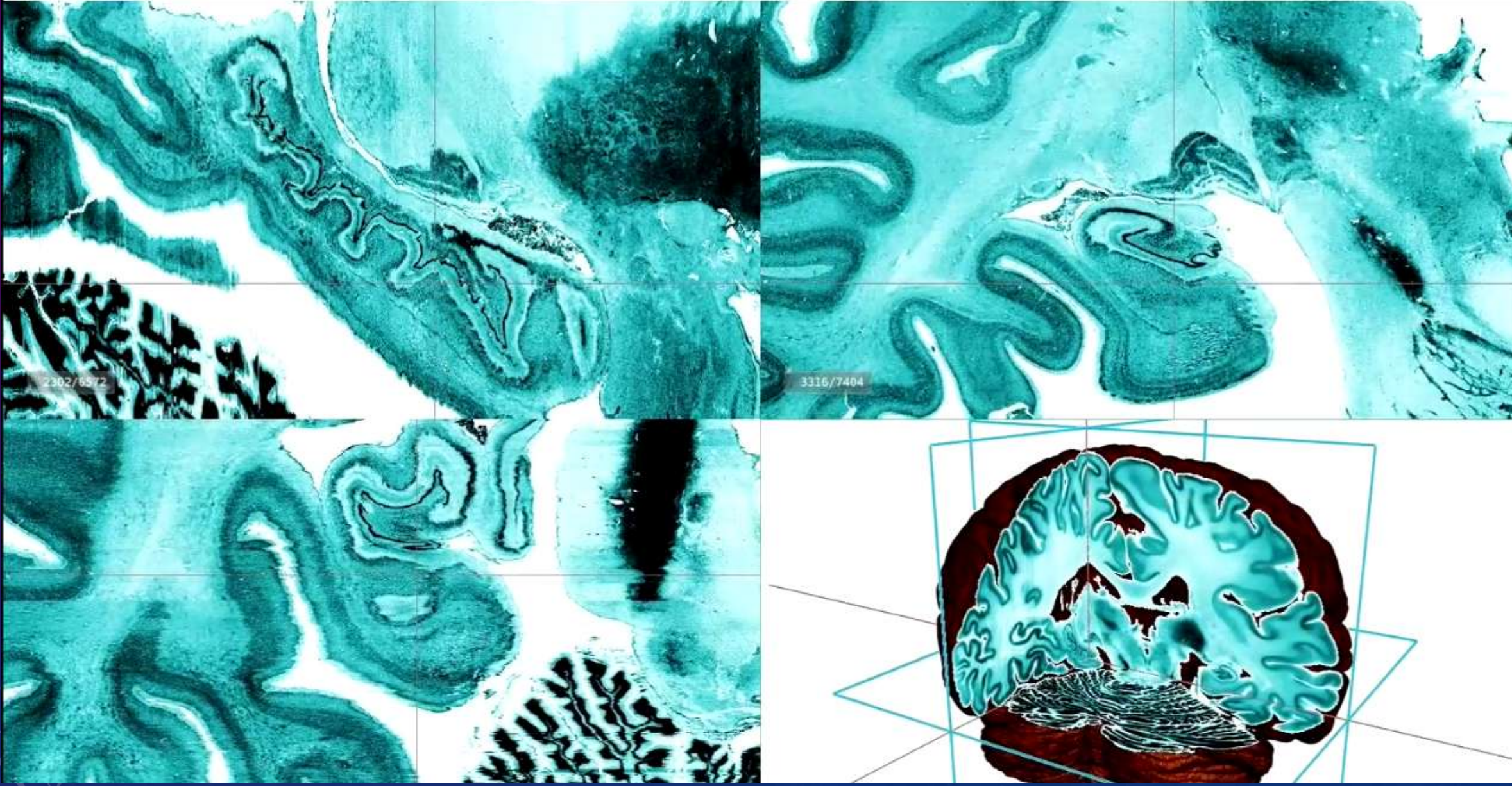


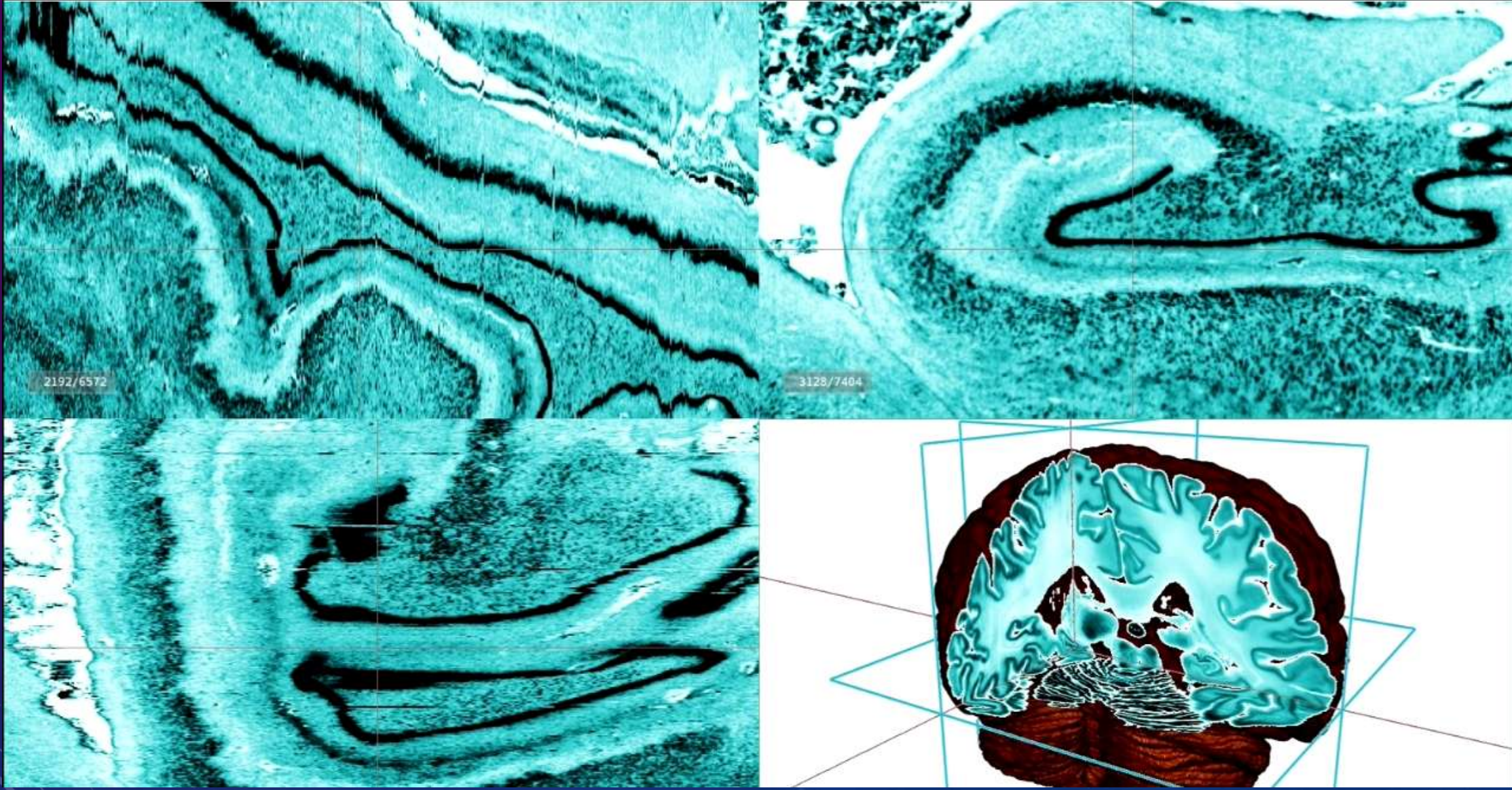
3D Reconstruction of the BigBrain











Hi-Resolution Sections · Cells (Nissl Staining) · Virtual Microscopy

Frontal sections (Nissl) from the Atlas Brain:

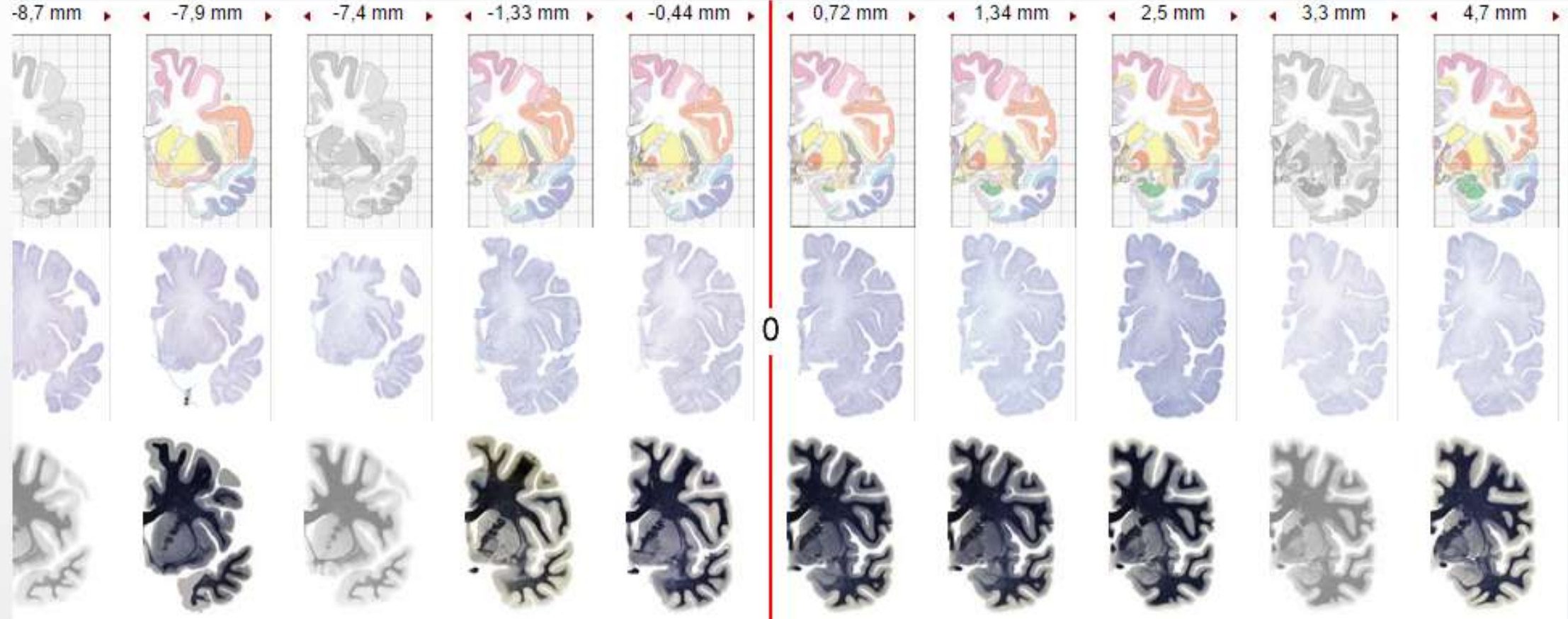
Single



Slice



Gallery



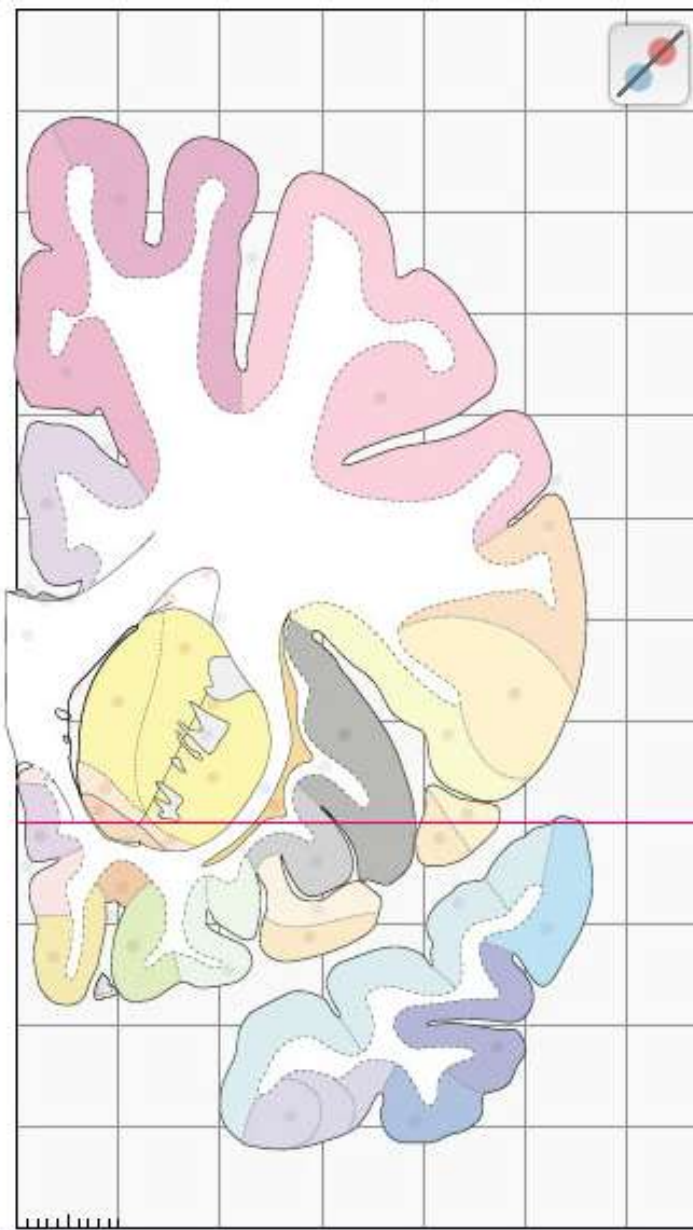


Atlas of the Human Brain - www.thehumanbrain.info

Detailed Human Brain - Plate 12

HIDE TEXT

READ MORE



12

-15.0 mm

Cortex

AOI	area orbitoinsularis
BOp	basal operculum
cals	callosal sulcus
CG	cingulate gyrus
cgs	cingulate sulcus
FOp	frontal operculum
IFGOp	inferior frontal gyrus, opercular part
IFGOl	inferior frontal gyrus, orbital part
IFGTr	inferior frontal gyrus, triangular part
ifs	inferior frontal sulcus
IG	insular gyrus
IGr	indusium griseum
ITG	inferior temporal gyrus
ITP	Inferior temporopolar region
MFG	middle frontal gyrus
MOrG	medial orbital gyrus
MTG	middle temporal gyrus
OlfA	olfactory area
olfs	olfactory sulcus
POrG	posterior orbital gyrus
PPo	planum polare
SFGl	superior frontal gyrus, lateral part

☒ Cortex

☒ Topographic

☒ Subcortical Gray

☒ Fiber Tracts

?

HELP



CHANGE LANGUAGE

SEARCH

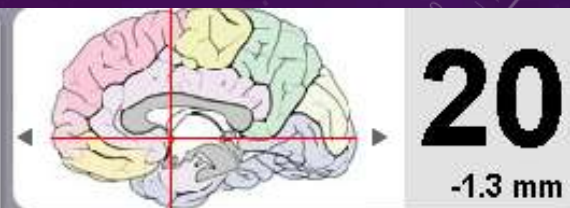
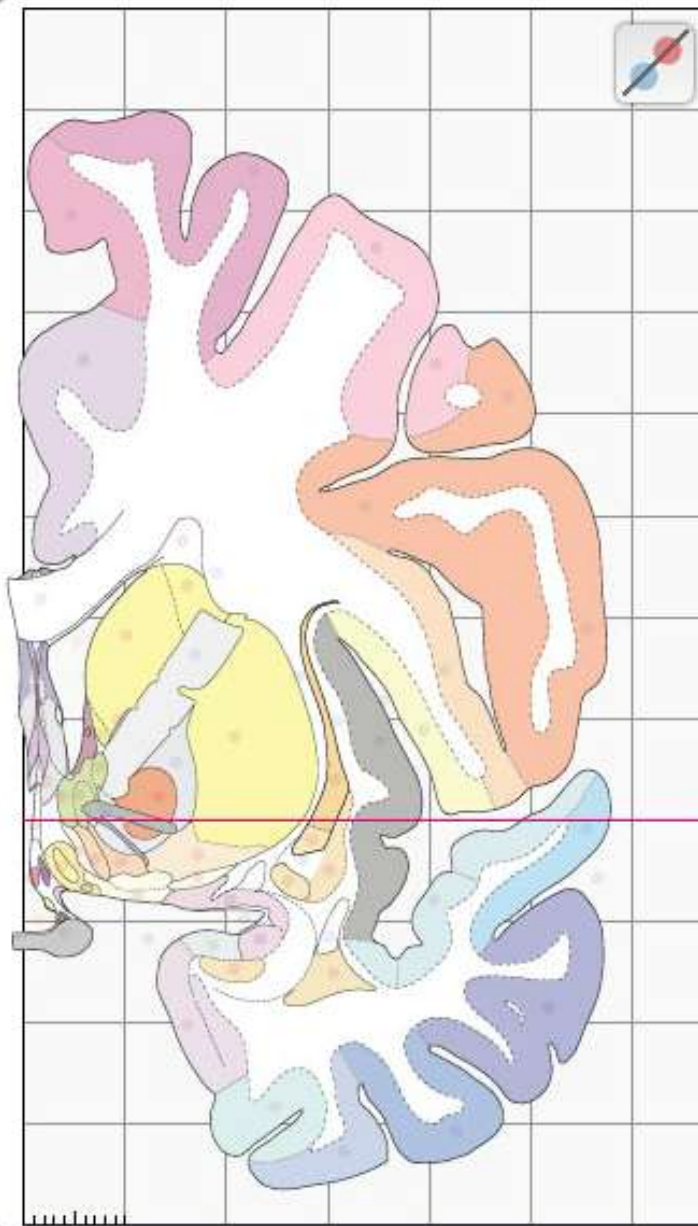


Atlas of the Human Brain - www.thehumanbrain.info

Detailed Human Brain - Plate 20

HIDE TEXT

READ MORE



20
-1.3 mm

Cortex

CG	cingulate gyrus
cir	circular insular sulcus
Ent	entorhinal cortex
FOp	frontal operculum
FuG	fusiform gyrus
IFGOp	inferior frontal gyrus, opercular part
IGr	indusium griseum
Ins	insula
ITG	inferior temporal gyrus
Li	limen insulae
MFG	middle frontal gyrus
MTG	middle temporal gyrus
PAM	periamygdaloid cortex
PirF	piriform cortex, frontal area
PirT	piriform cortex, temporal area
PPo	planum polare
PRC	perirhinal cortex
PrG	precentral gyrus
SFGL	superior frontal gyrus, lateral part
SFGM	superior frontal gyrus, medial part
STG	superior temporal gyrus
etc	superior temporal sulcus

SEARCH



CHANGE LANGUAGE

☒ Cortex

☒ Topographic

☒ Subcortical Gray

☒ Fiber Tracts

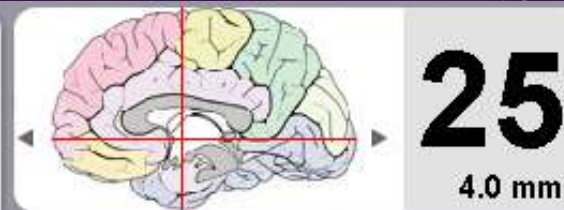
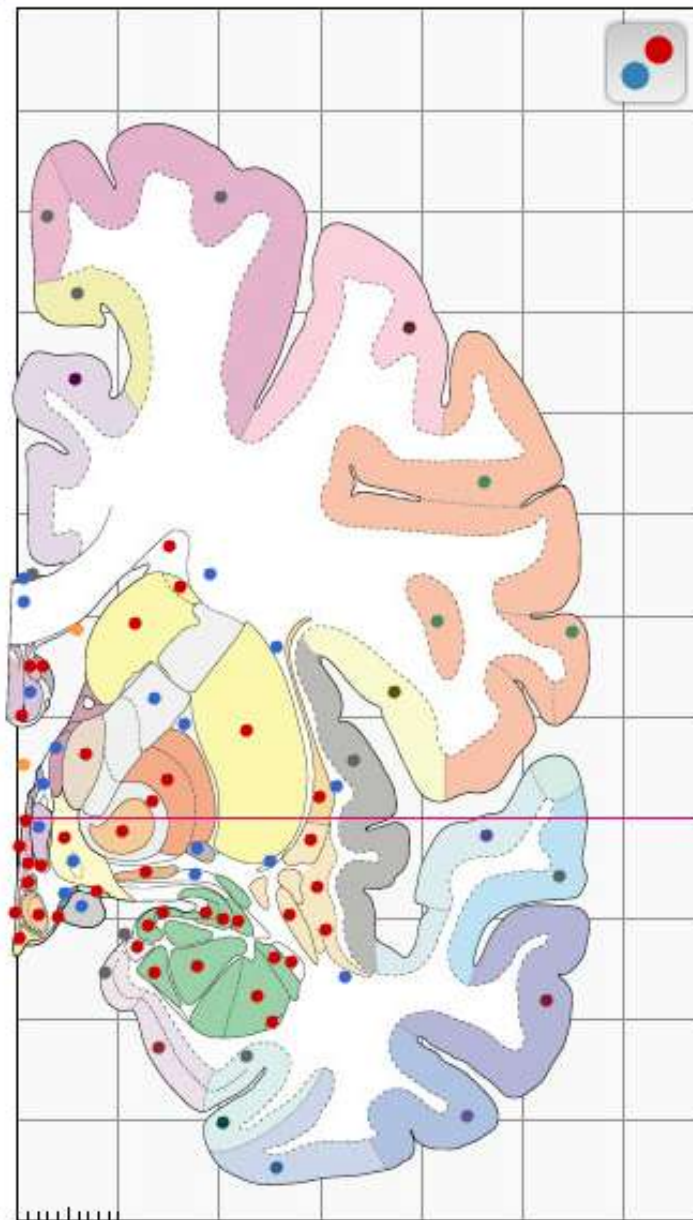


Atlas of the Human Brain - www.thehumanbrain.info

Detailed Human Brain - Plate 25

HIDE TEXT

READ MORE



25
4.0 mm

Cortex

CG	cingulate gyrus
Ent	entorhinal cortex
FOp	frontal operculum
FuG	fusiform gyrus
IGr	indusium griseum
Ins	insula
ITG	inferior temporal gyrus
MFG	middle frontal gyrus
MTG	middle temporal gyrus
PCL	paracentral lobule
PHG	parahippocampal gyrus
PPo	planum polare
PRC	perirhinal cortex
PrG	precentral gyrus
sas	semiannular sulcus
SFGL	superior frontal gyrus, lateral part
SFGM	superior frontal gyrus, medial part
STG	superior temporal gyrus
Un	uncus

Fiber Tracts

ac	anterior commissure
cc	corpus callosum

☒ Cortex

☒ Topographic

☒ Subcortical Gray

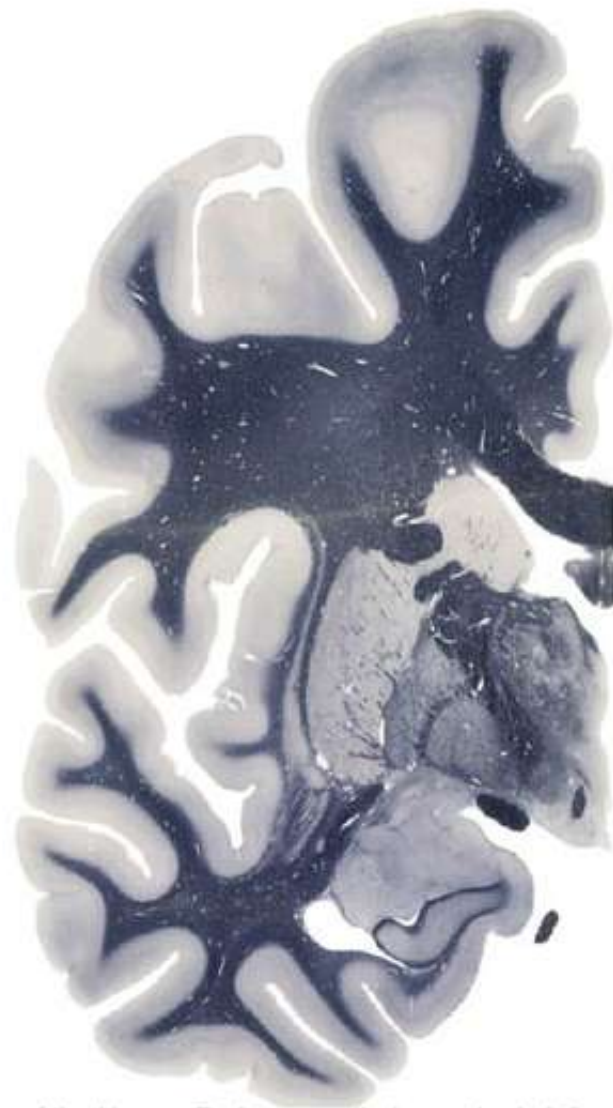
☒ Fiber Tracts

SEARCH

HELP



CHANGE LANGUAGE

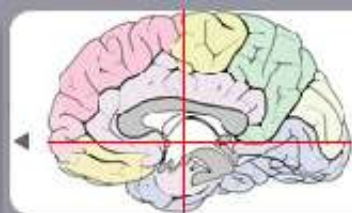
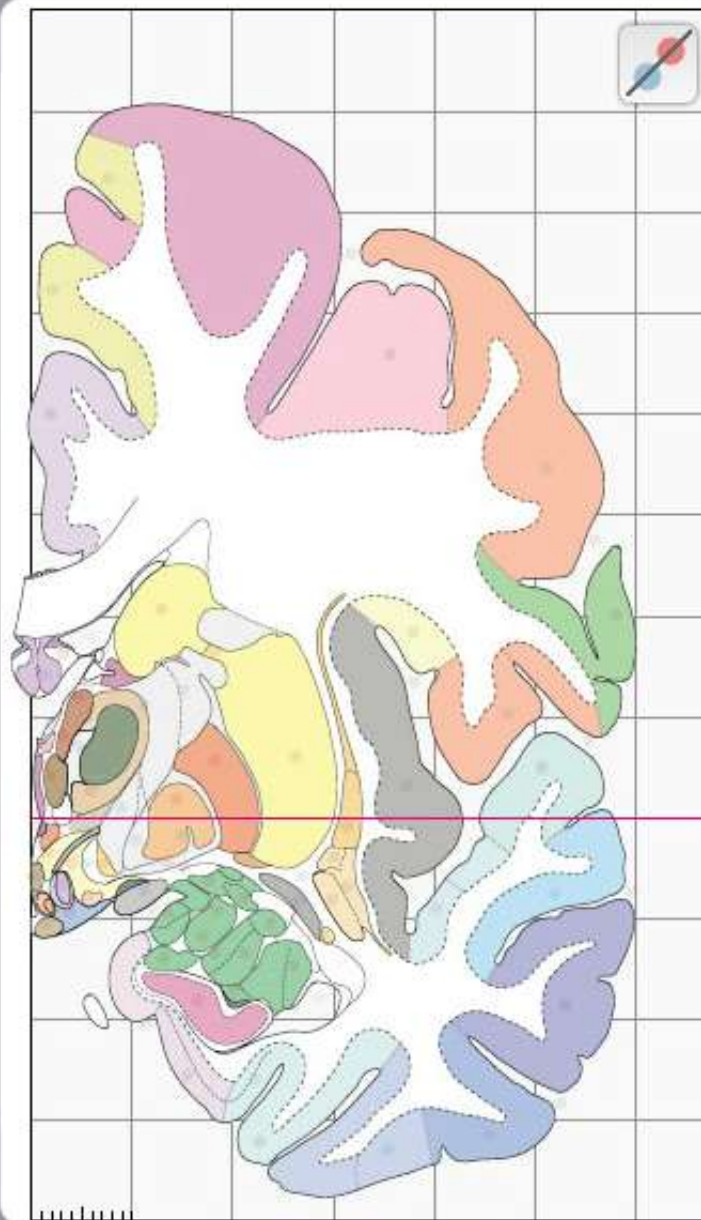


Atlas of the Human Brain - www.thehumanbrain.info

Detailed Human Brain - Plate 28

HIDE TEXT

READ MORE



28

8.0 mm

Cortex

ce	central sulcus
CG	cingulate gyrus
cir	circular insular sulcus
Ent	entorhinal cortex
FOp	frontal operculum
FuG	fusiform gyrus
Ins	insula
ITG	inferior temporal gyrus
its	inferior temporal sulcus
If	lateral fissure
MFG	middle frontal gyrus
MM	medial mamillary nucleus, medial part
MTG	middle temporal gyrus
PCL	paracentral lobule
PCL	paracentral lobule
PHG	parahippocampal gyrus
PoG	postcentral gyrus
PPo	planum polare
PRC	perirhinal cortex
PrG	precentral gyrus
Pu	putamen
sas	semiannular sulcus

☒ Cortex

☒ Topographic

☒ Subcortical Gray

☒ Fiber Tracts

HELP



CHANGE LANGUAGE

SEARCH

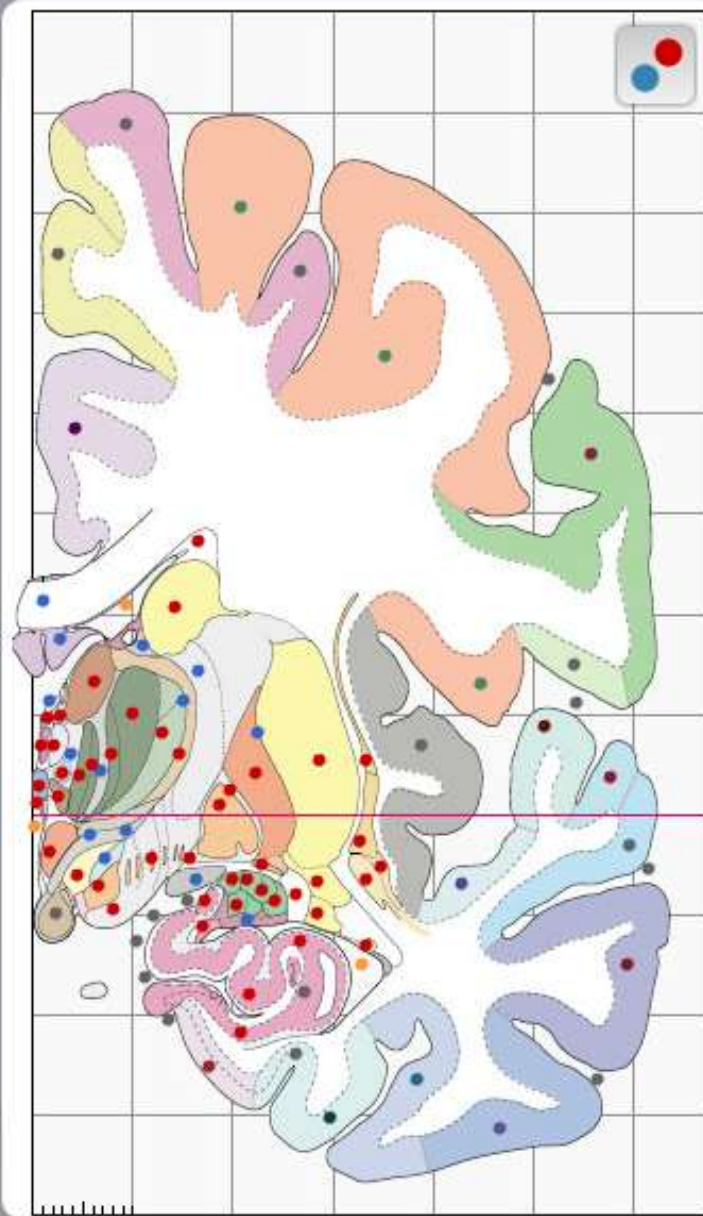


Atlas of the Human Brain - www.thehumanbrain.info

Detailed Human Brain - Plate 31

HIDE TEXT

READ MORE



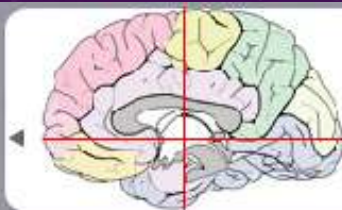
?

HELP



CHANGE LANGUAGE

SEARCH



31

12.0 mm

■ AG	ambiens gyrus
■ ce	central sulcus
■ CG	cingulate gyrus
■ DG	dentate gyrus
■ Ent	entorhinal cortex
■ FuG	fusiform gyrus
■ Ins	insula
■ ITG	inferior temporal gyrus
■ its	inferior temporal sulcus
■ If	lateral fissure
■ MTG	middle temporal gyrus
■ PCL	paracentral lobule
■ PHG	parahippocampal gyrus
■ PoG	postcentral gyrus
■ POp	parietal operculum
■ PPO	planum polare
■ PRC	perirhinal cortex
■ PrG	precentral gyrus
■ PTe	planum temporale
■ SFGL	superior frontal gyrus, lateral part
■ SLG	semilunar gyrus
■ STG	superior temporal gyrus
■ sts	superior temporal sulcus

☒ Cortex

☒ Topographic

☒ Subcortical Gray

☒ Fiber Tracts

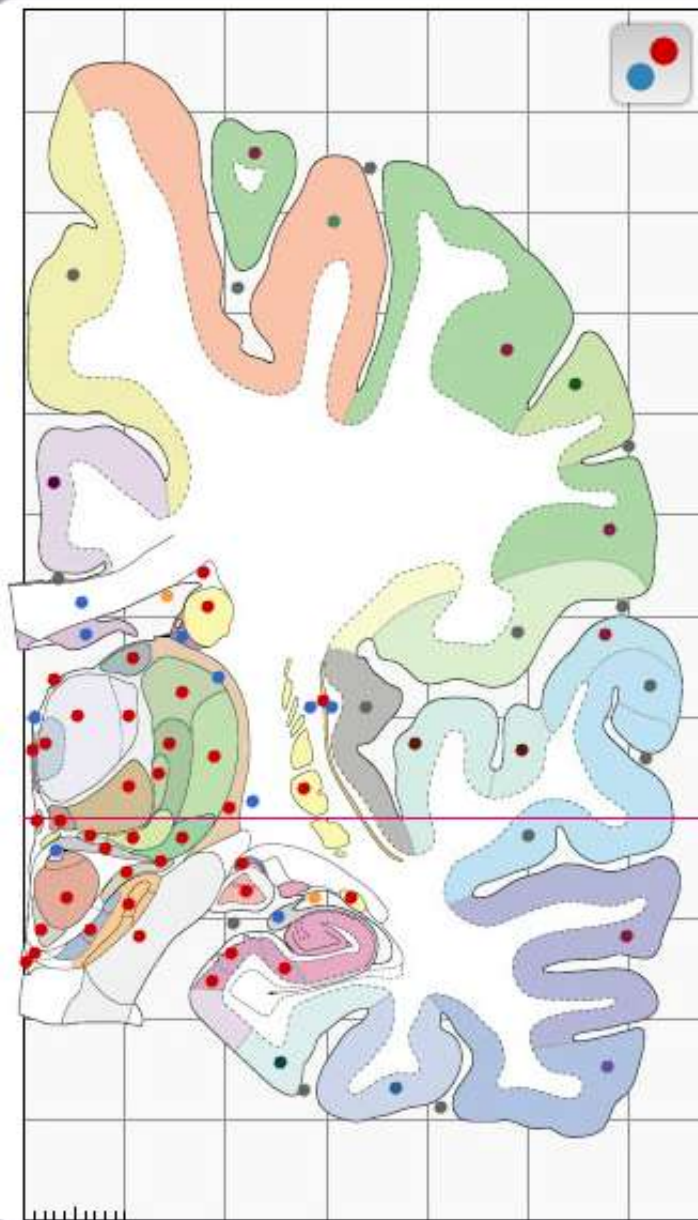


Atlas of the Human Brain - www.thehumanbrain.info

Detailed Human Brain - Plate 40

HIDE TEXT

READ MORE



40
23.9 mm

Cortex

■ ce	central sulcus
■ CG	cingulate gyrus
■ cos	collateral sulcus
■ cp	cerebral peduncle
■ FuG	fusiform gyrus
■ his	hippocampal sulcus
■ IGr	indusium griseum
■ Ins	insula
■ ITG	inferior temporal gyrus
■ If	lateral fissure
■ lots	lateral occipitotemporal sulcus
■ LV	lateral ventricle
■ MTG	middle temporal gyrus
■ PCL	paracentral lobule
■ PHG	parahippocampal gyrus
■ pocs	postcentral sulcus
■ PoG	postcentral gyrus
■ POp	parietal operculum
■ PrG	precentral gyrus
■ PrS	presubiculum
■ PTe	planum temporale
■ Pr	paraventricular thalamic nucleus

☒ Cortex

☒ Topographic

☒ Subcortical Gray

☒ Fiber Tracts

SEARCH

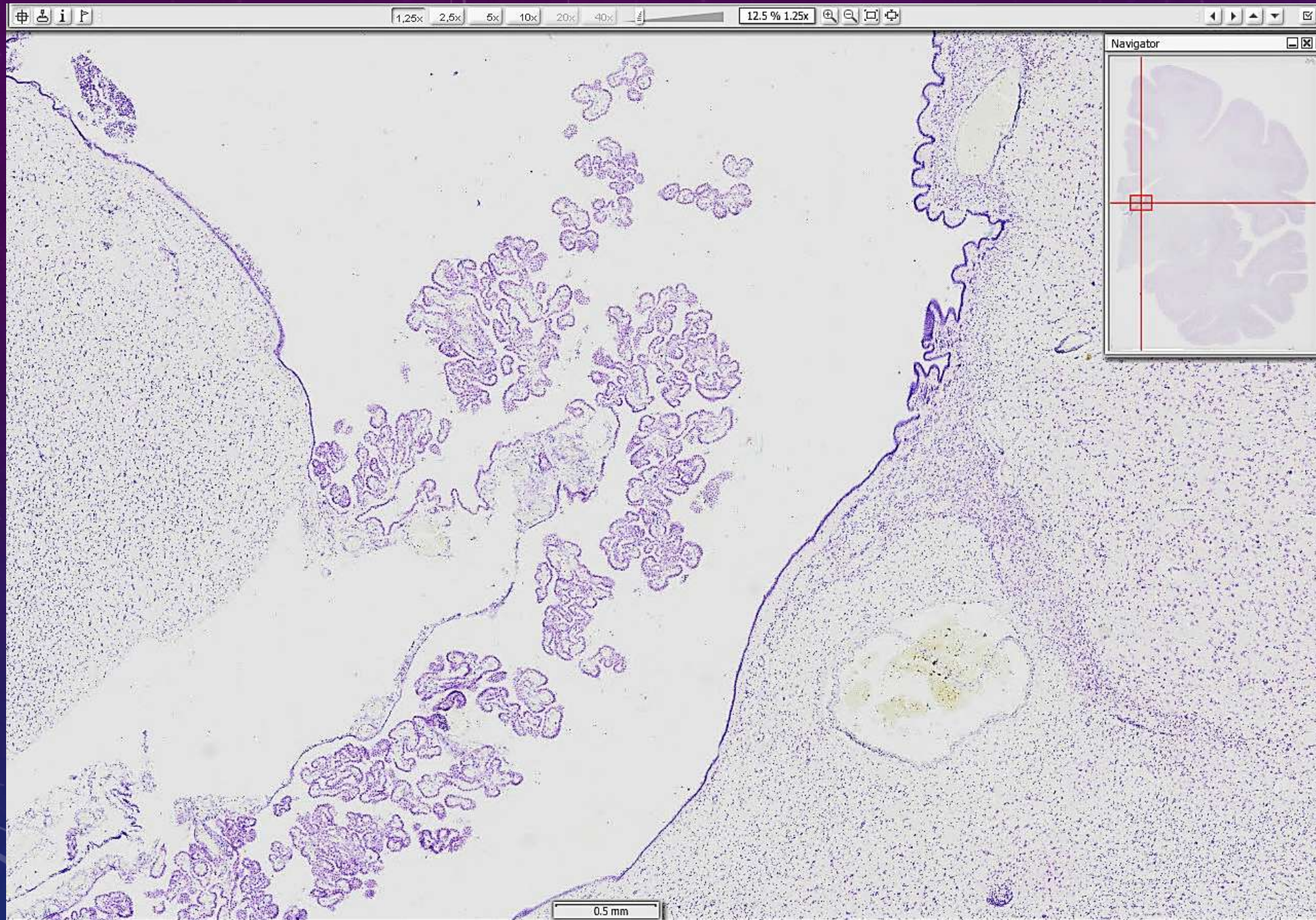
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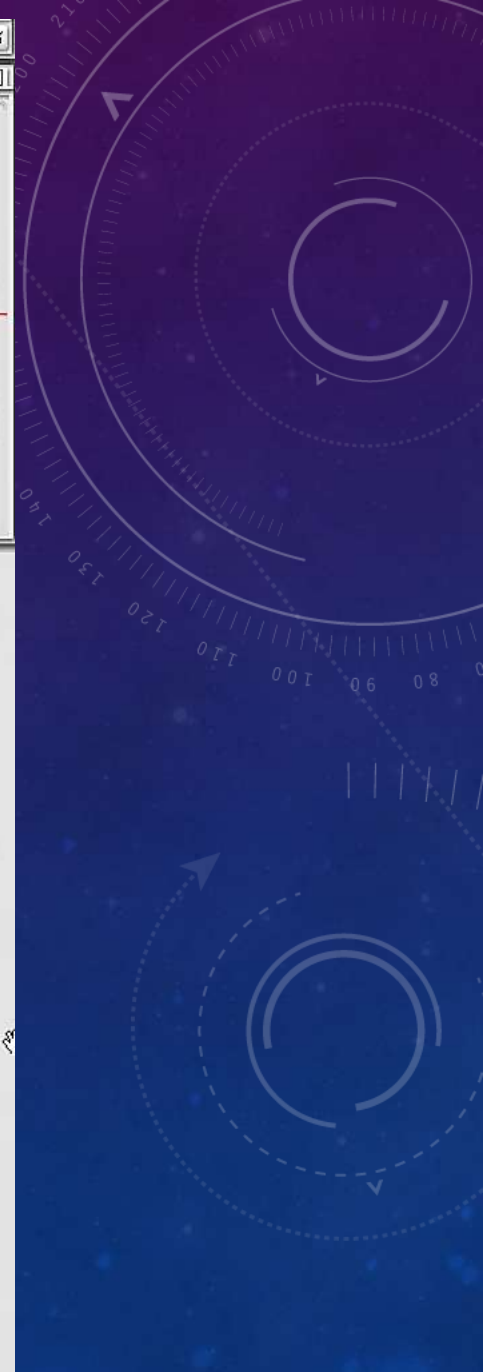


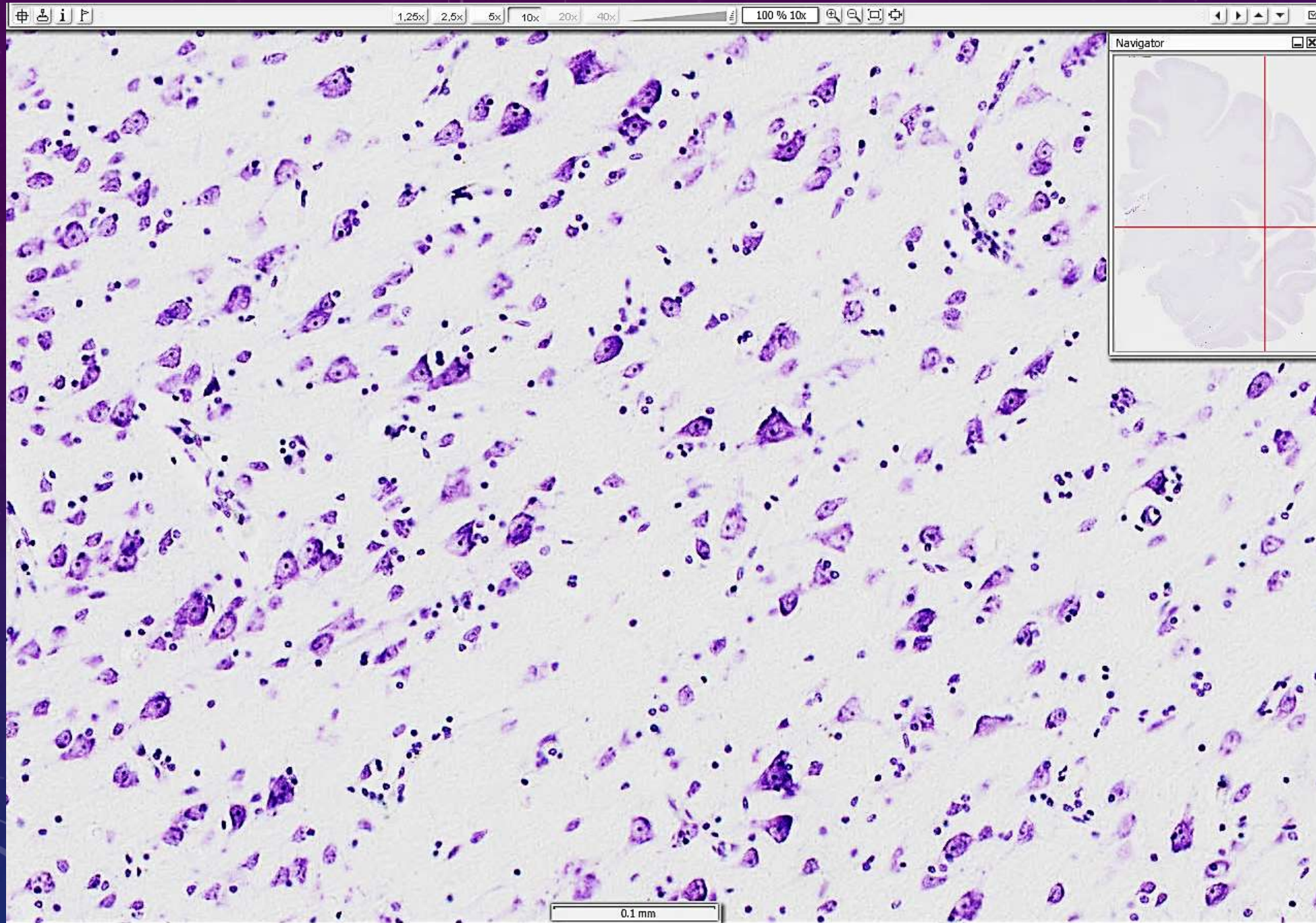
CHANGE LANGUAGE











HISTOQUÍMICA CLÁSSICA

- Cajal: Neurônios, astrócitos, nervos.
- Golgi (Impregnação cromo-argêntea): neurônios-Purkinje, astrócitos.
- Hortega: astrócitos, micróglia, oligodendrócitos.
- Galocianina, Tionina, Nissl (Violeta Cresil): Substância de Nissl
- Holtzer: Fibras da glia, glia
- Hematoxilina Férrica Lopez: Mielina
- Weigert-Pal: Mielina
- LFB: Mielina

- **Luxol-fast-blue - Nissl (Klüver-Barrera) para mielina e neurônios.**
(<http://anatpat.unicamp.br/tecnicashistologicas.html#t27a>)

Luxol-fast-blue 0,1%

Luxol-fast-blue MBS 0,1 g.

Etanol 95% 100 ml.

Dissolver o corante no álcool. Acrescentar 0,5 ml de ácido acético 10% por 100 ml de solução.

Cresil – violeta 0,1%

Cresil violeta 0,1 g.

Água destilada 100 ml.

Imediatamente antes do uso, adicionar 15 gotas de ácido acético a 10%. Filtrar antes do uso.

Carbonato de lítio 0,05 %

Carbonato de lítio 0,05 g.

Água destilada 100 ml.

Procedimento:

1. Corar pela solução de Luxol fast blue durante a noite em estufa a 56%. Etanol 95 %.
2. Lavar em água destilada.
3. Diferenciar com carbonato de lítio, cerca de 30 segundos. Continuar a diferenciação em álcool 70% e ir agitando gentilmente até que a diferença entre substância branca e cinzenta fique nítida. Monitorar a mudança cromática à microscopia
4. Corar por solução de cresil violeta 6 min.
5. Desidratar rapidamente.
6. Montar

Resultados : mielina – azul turquesa; neurônios – azul violeta.

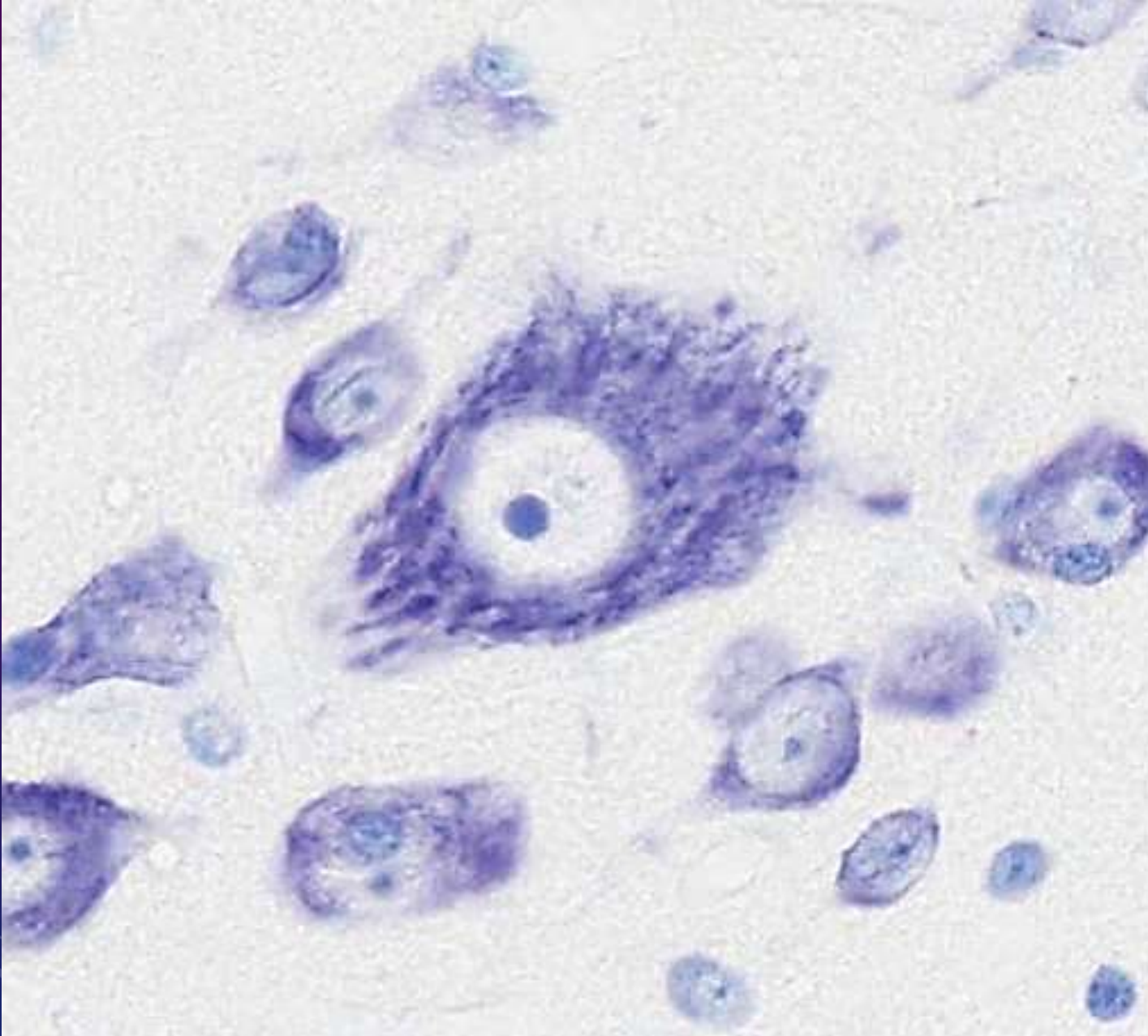
- **Nissl (Violeta Cresil)**

(<http://www.neurofisiologia.unifesp.br/protocolonissl.htm>)

1. Xilol I - H₂O destilada: 2 minutos
2. Corante cresil violeta: 2 a 7 minutos (controlar o tempo pela cor)
3. H₂O destilada : 5 mergulhos
4. Álcool 50º: 5 mergulhos
5. Álcool 70º: 5 mergulhos
6. Diferenciador (Ac. Acético 1% etanol) – 1 mergulho
7. Álcool 70º : 1 minuto até Xilol II
8. Montar

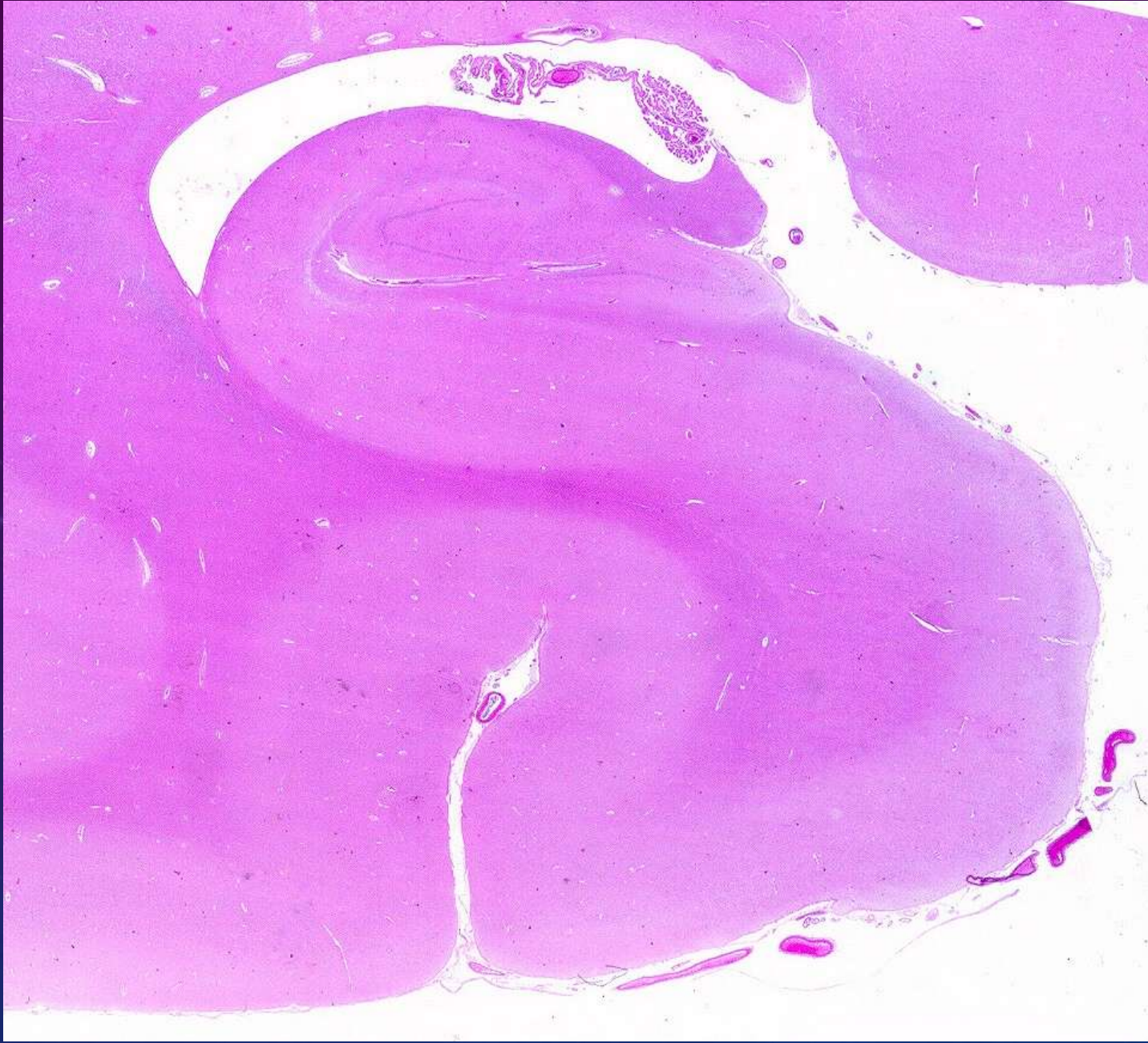
OBS: Hematoxilina de Harris por 5 minutos, lavar bem em água corrente até sair o excesso de corante, diferenciar em álcool e ácido (250 mL de álcool 70% + 2,5 mL de ácido clorídrico), passar rápido nesse diferenciador. Lavar bem em água corrente e passar para eosina alcoólica por 3 minutos. Desidratar.

Resultados: Neurônios, violeta.

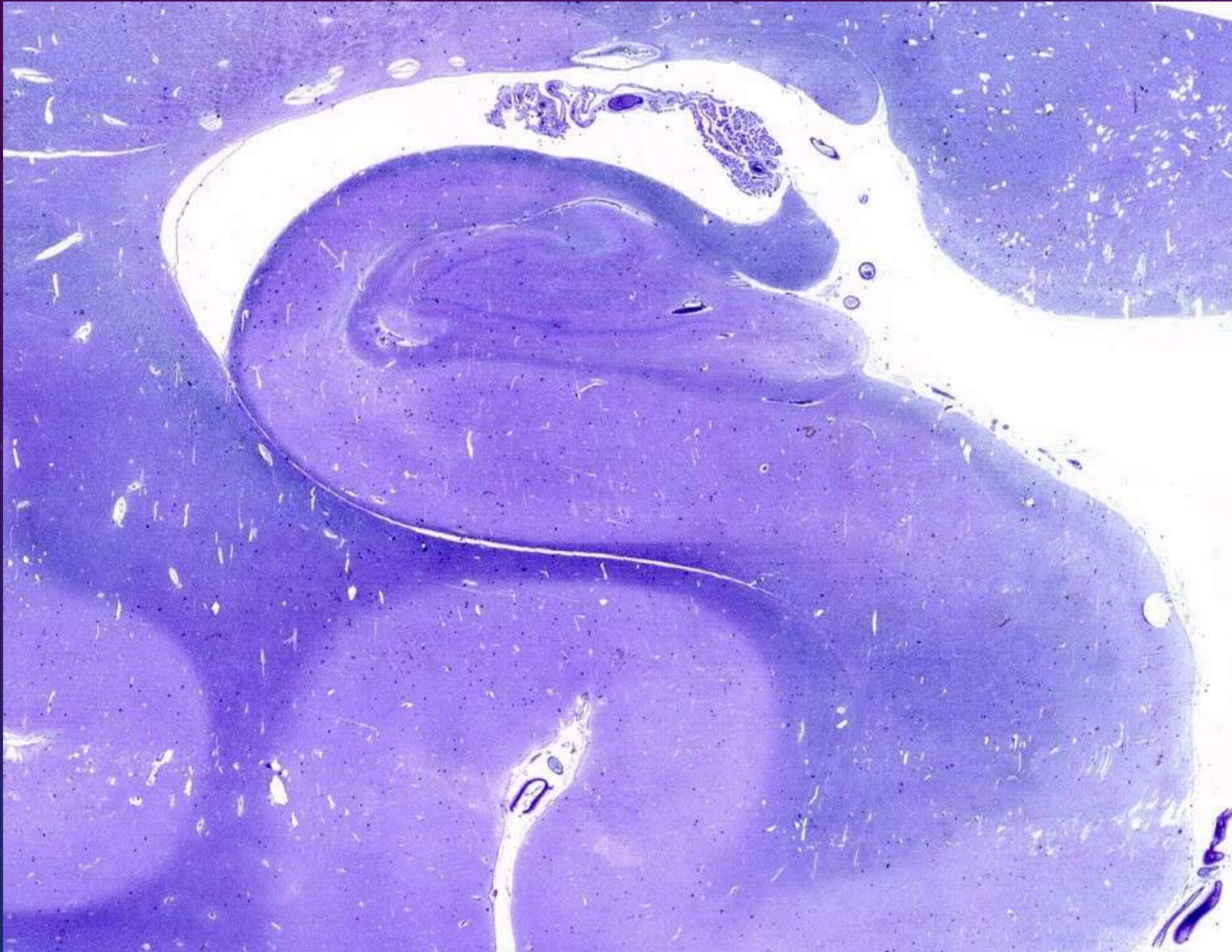


Nissl

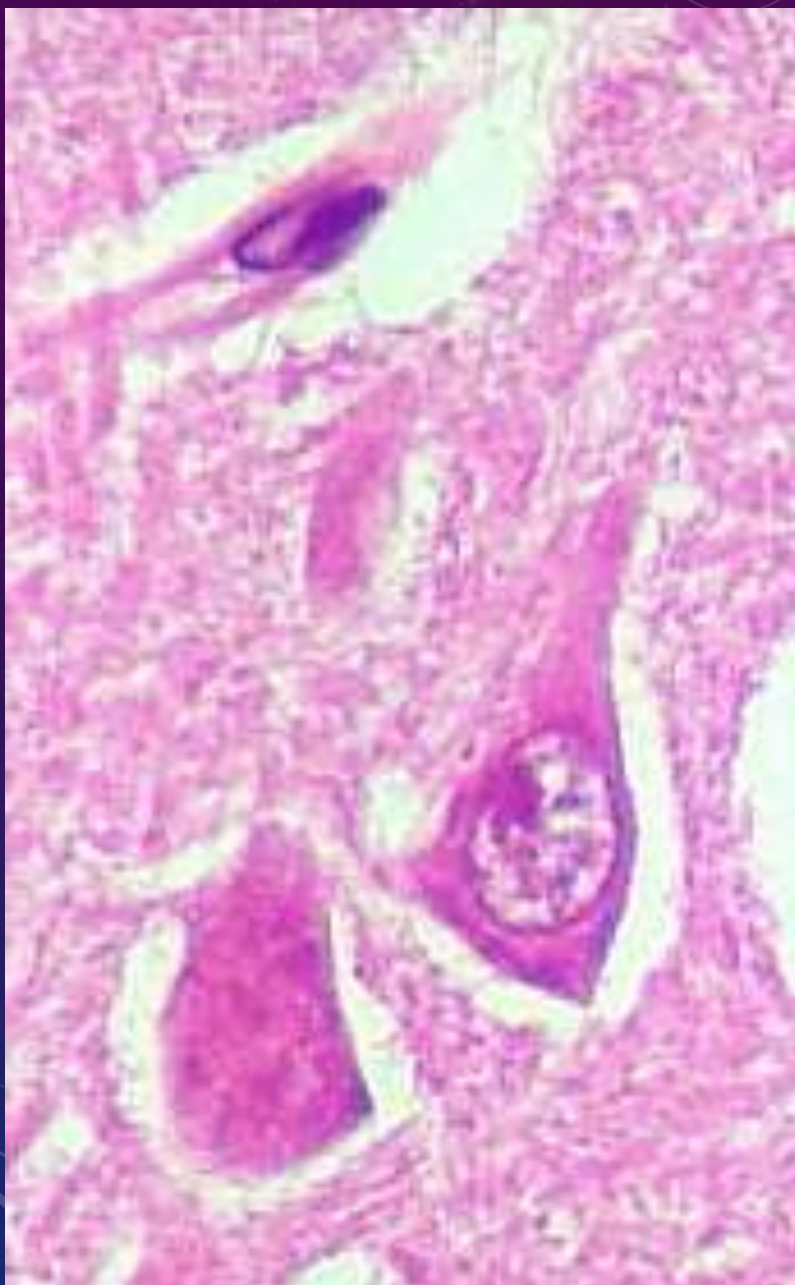
<http://anatpat.unicamp.br/neuro1.html>



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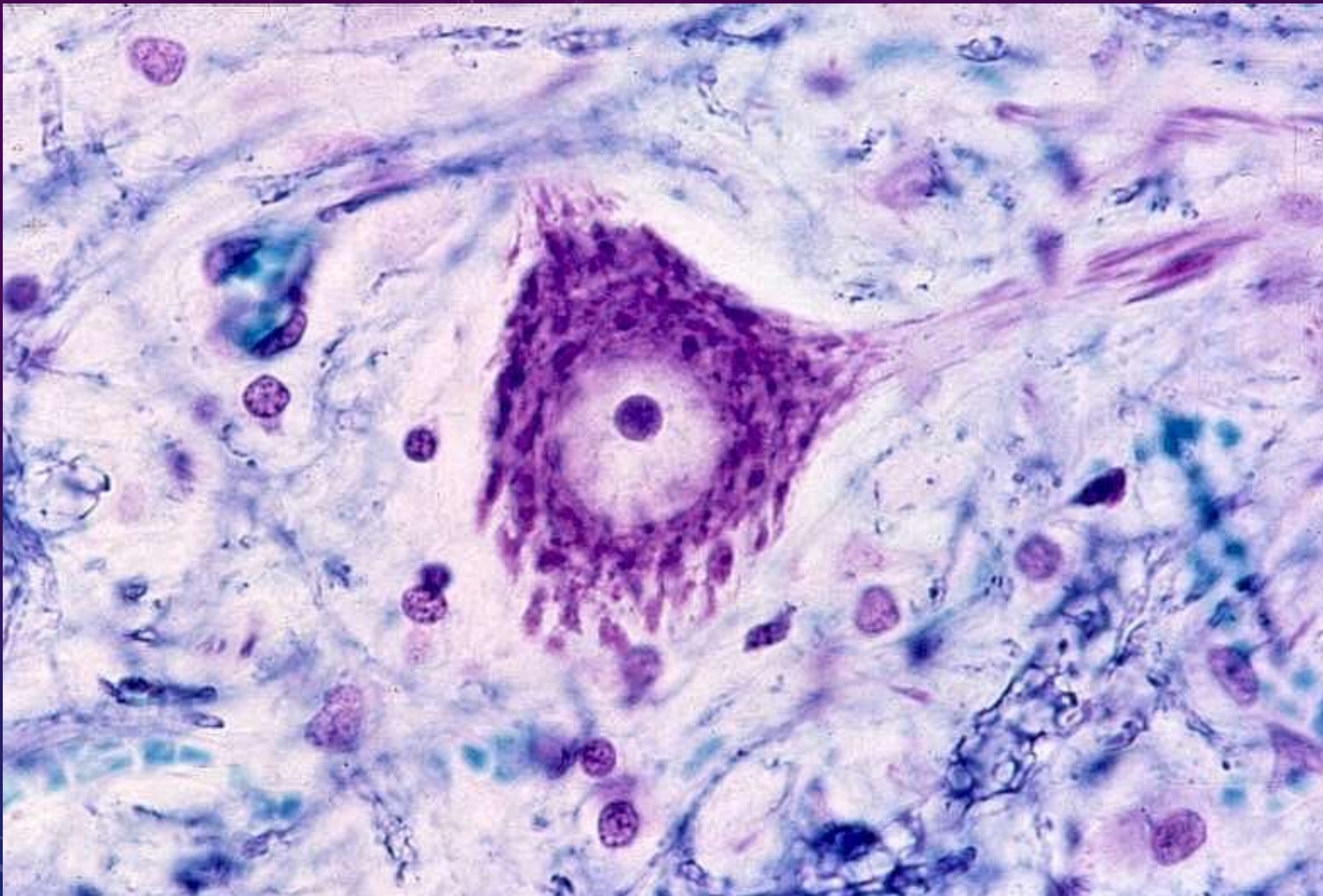
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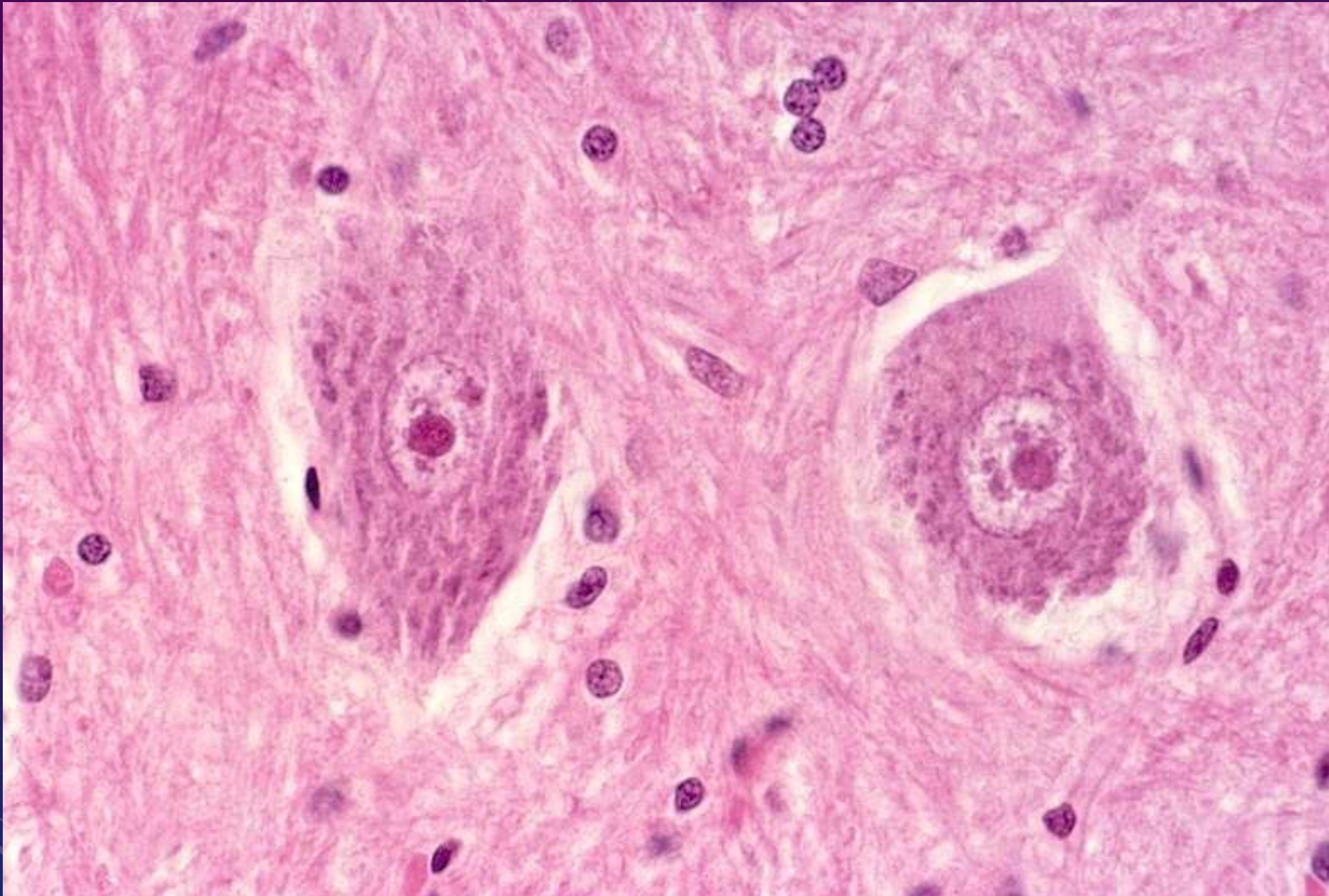
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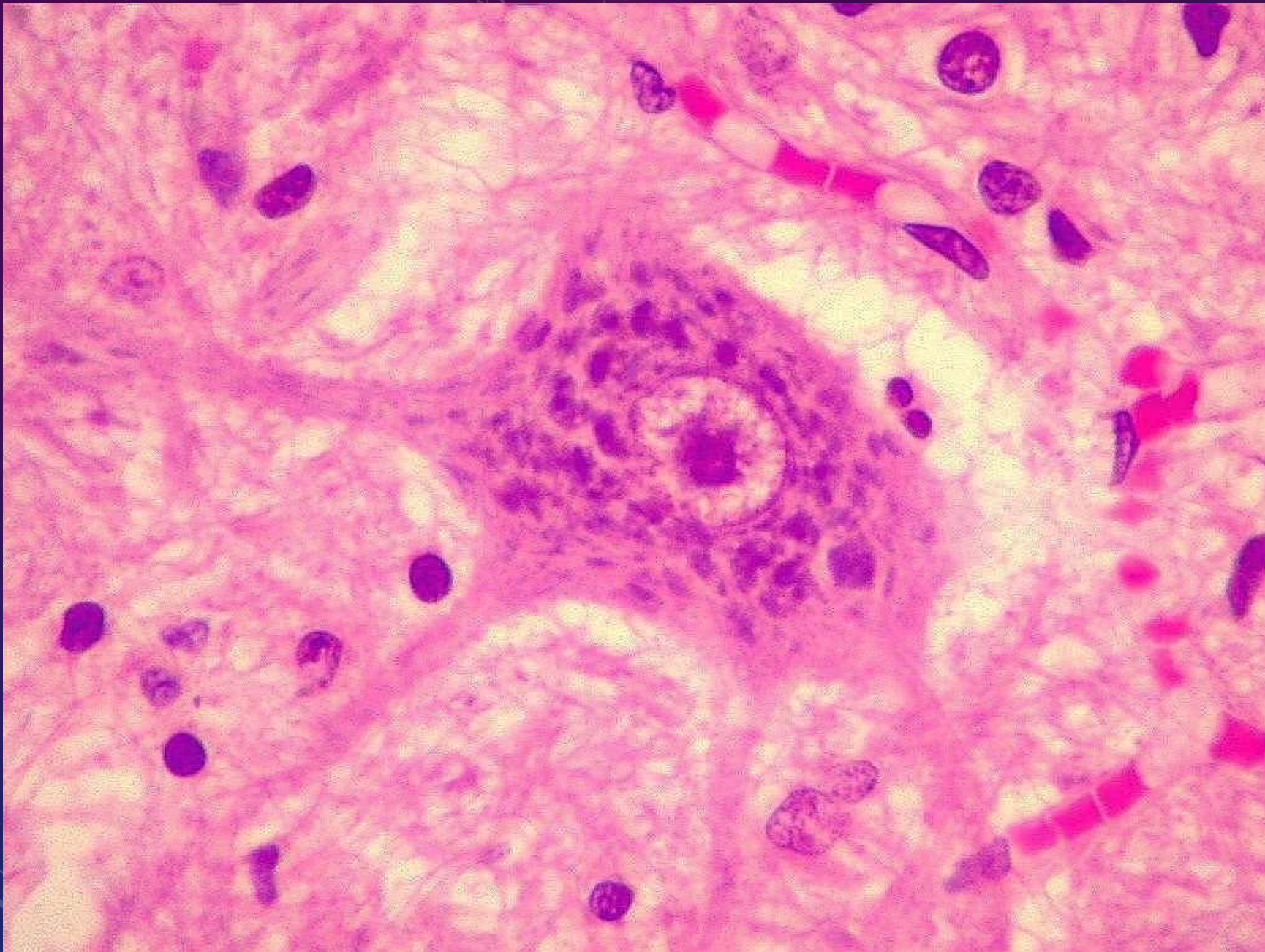
LFB



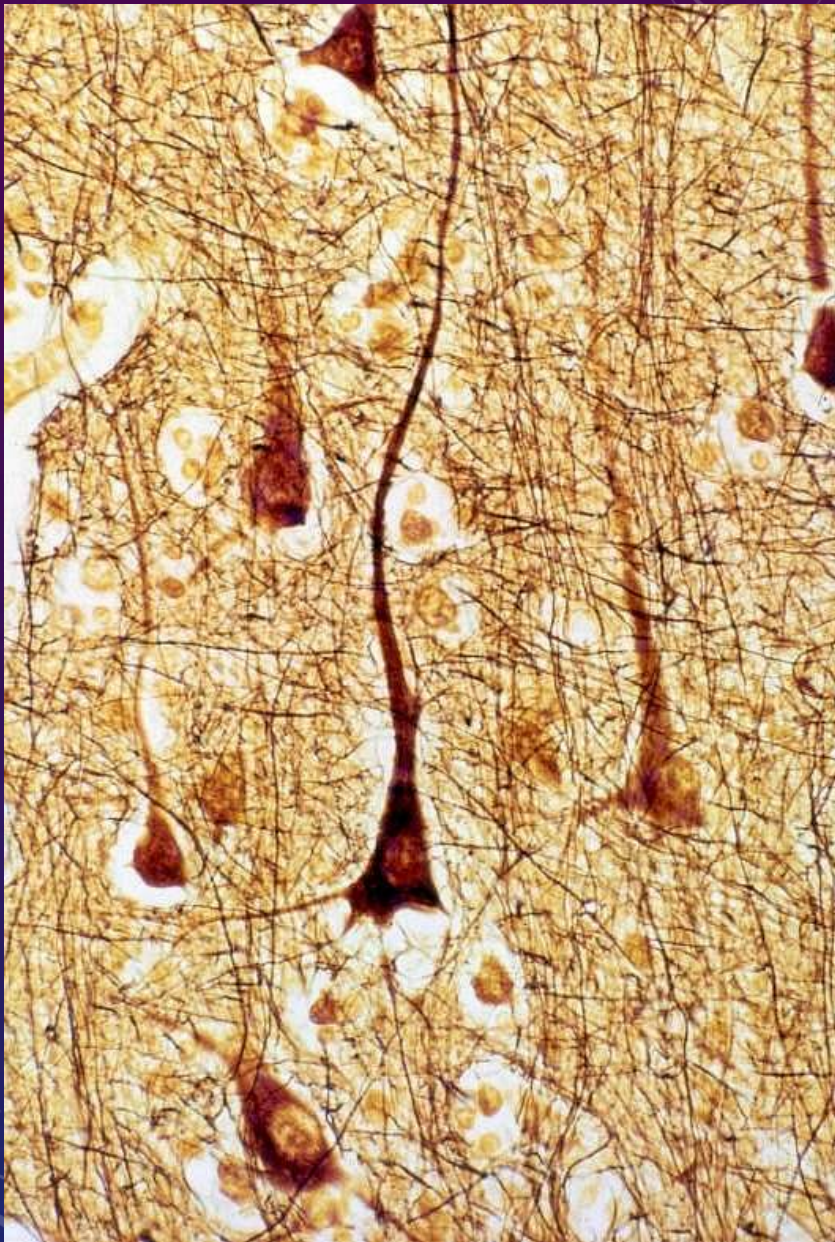
LFB+N



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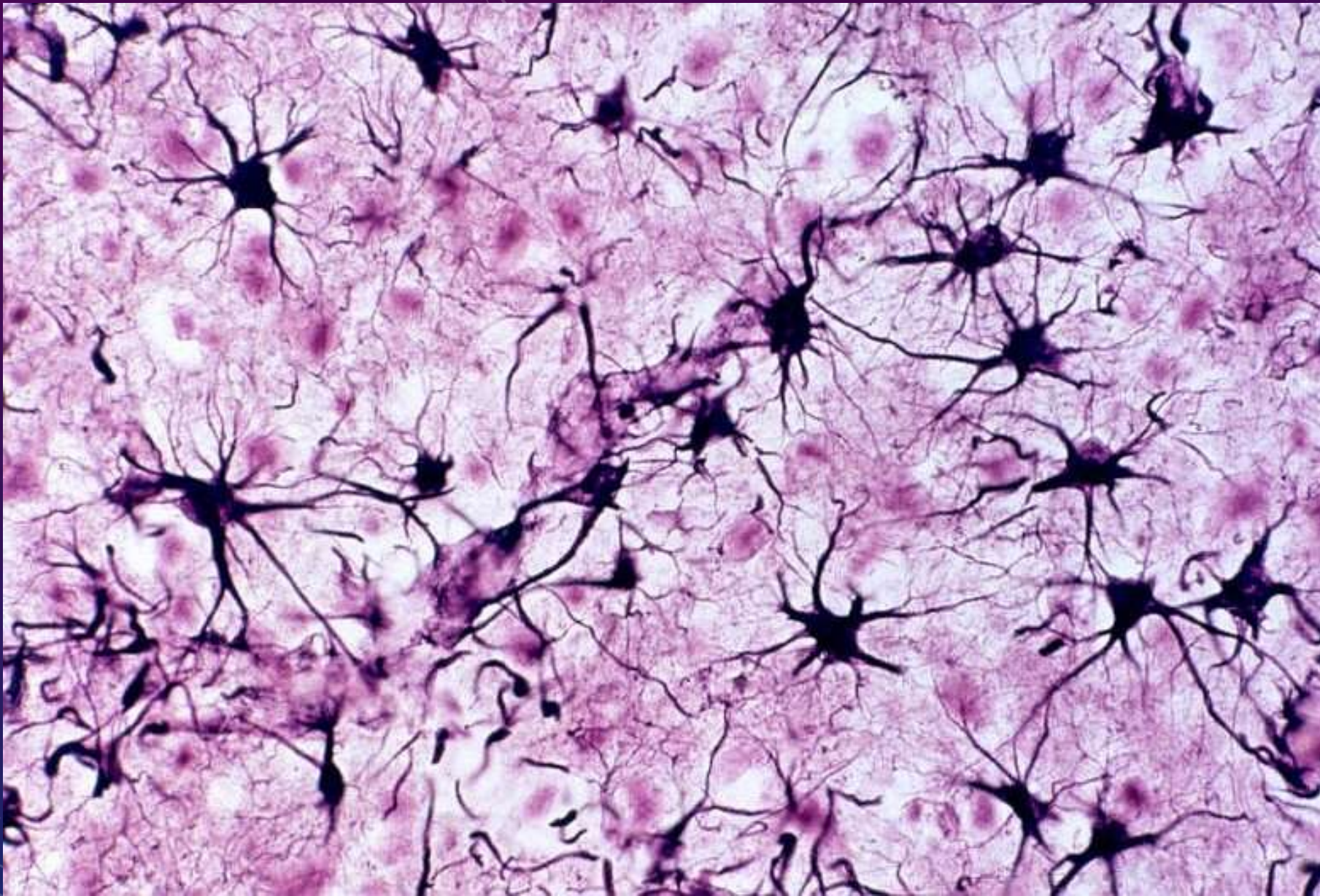
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Cajal



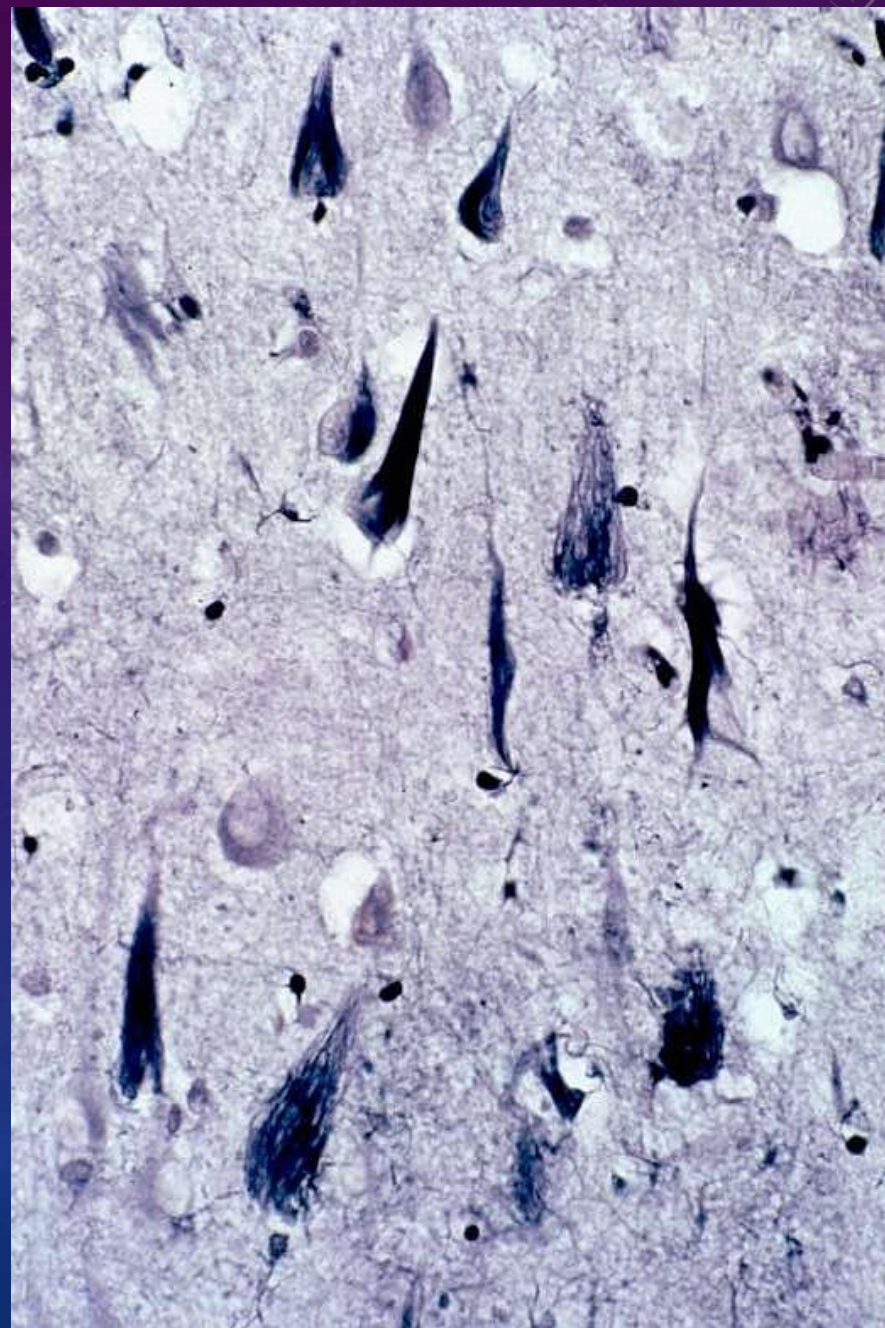
Holtzer



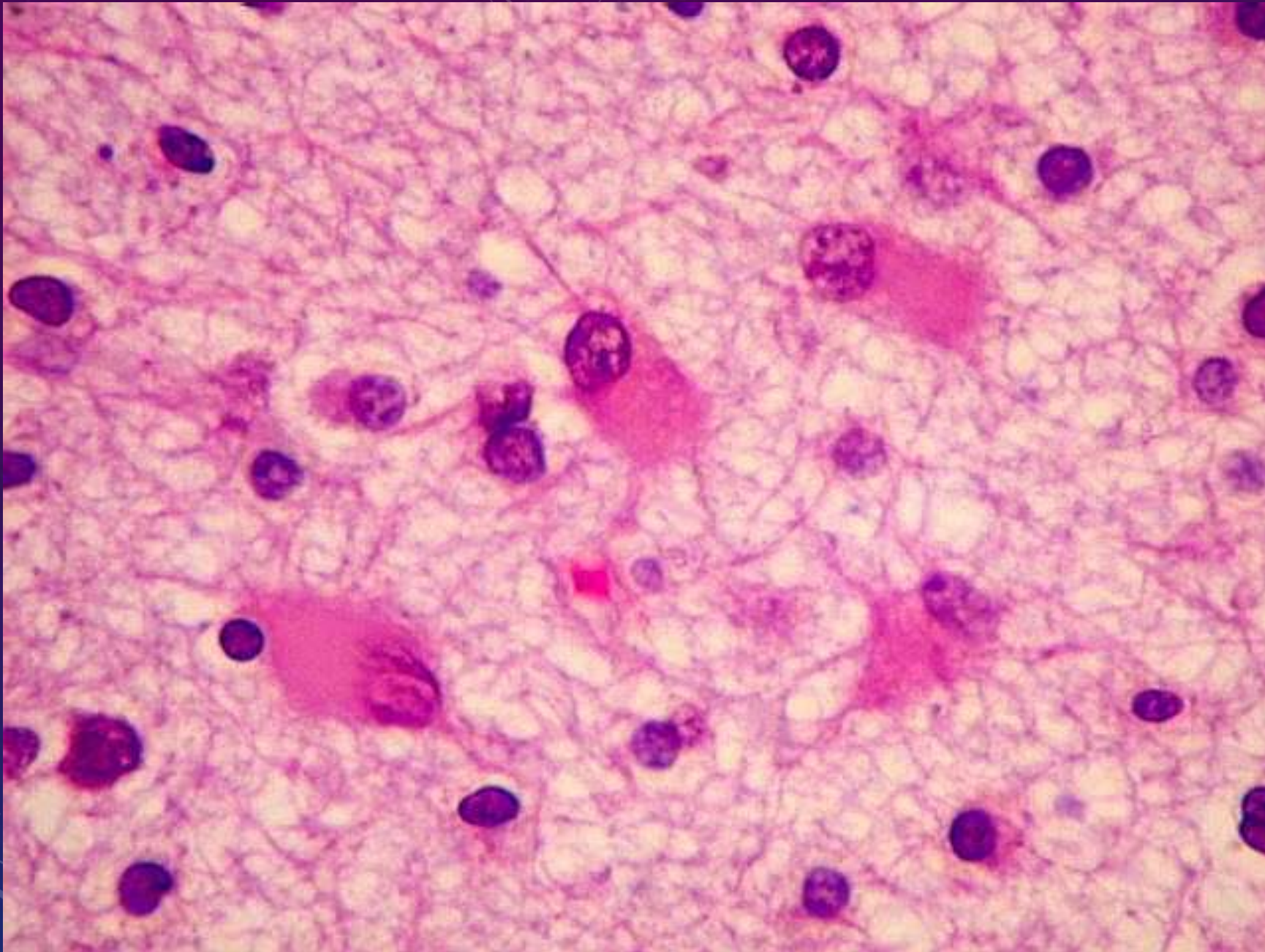
Cajal



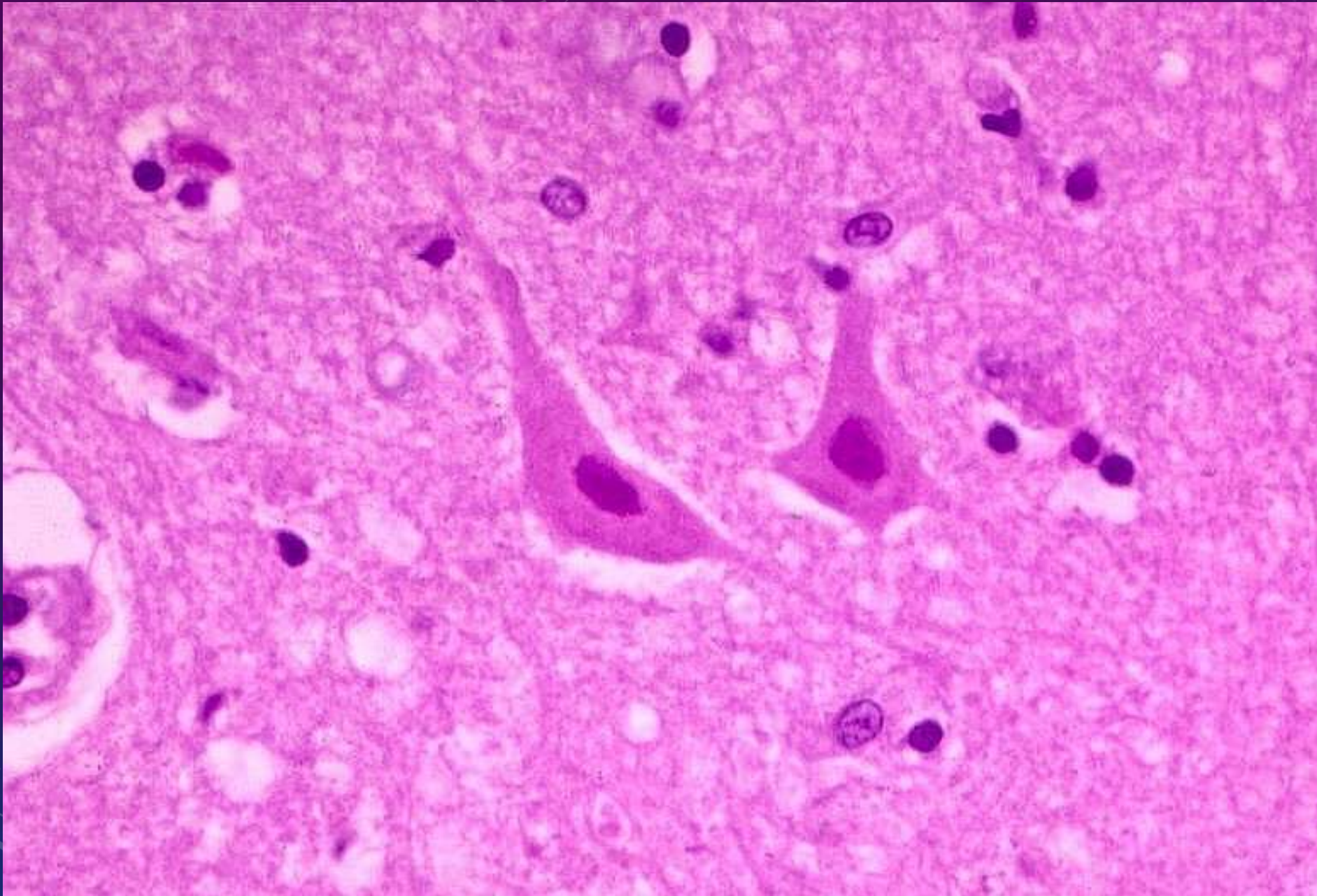
Vermelho
Congo



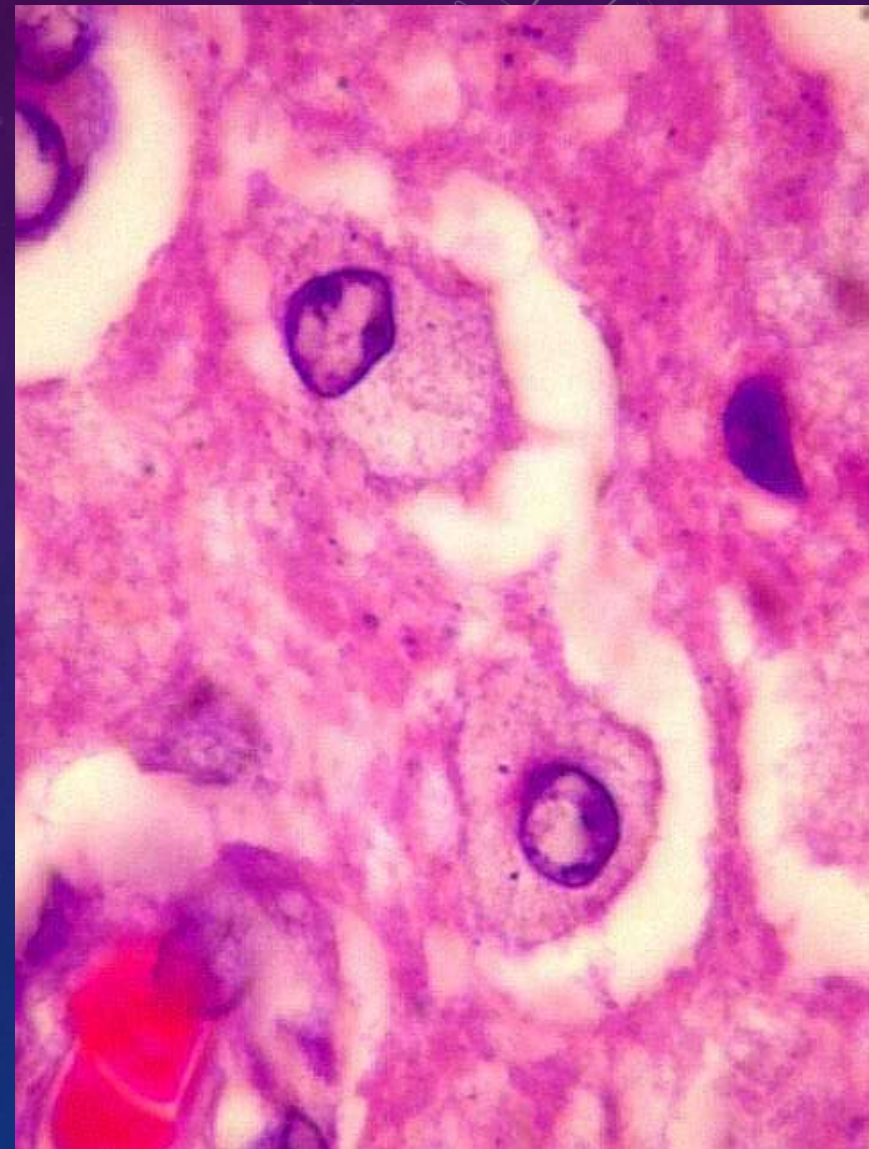
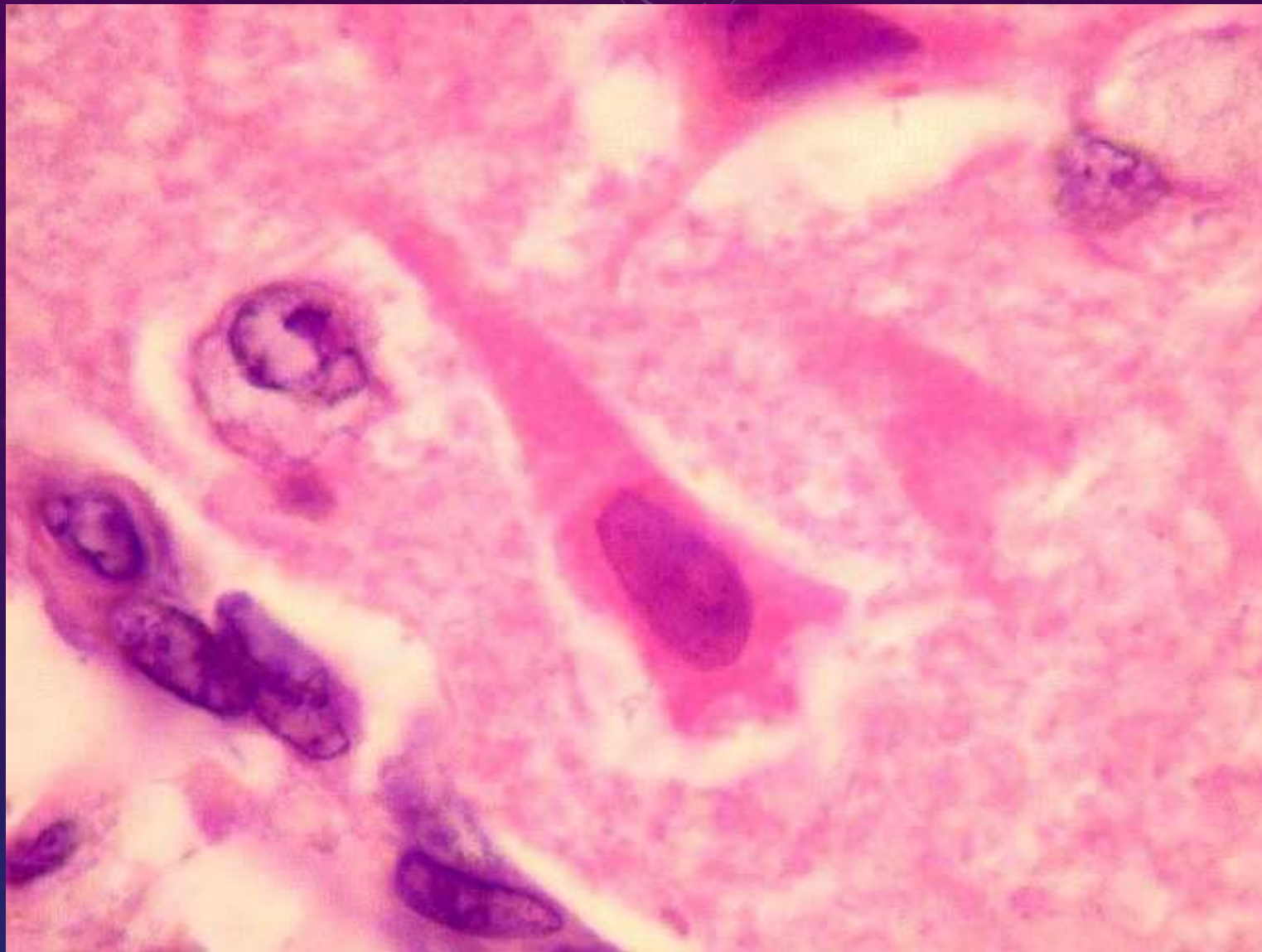
Prata



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REFERÊNCIAS BIBLIOGRÁFICAS

- https://bigbrain.loris.ca/images/media/BBvideo_HBM.mp4
- <http://www.livescience.com/42227-3d-images-human-brain.html>
- <http://anatpat.unicamp.br/neuro1.html>
- <http://anatpat.unicamp.br/neuroanatindex.html>
- http://www.thehumanbrain.info/brain/bn_brain_atlas/brain.html