L’électrogenèse corticale

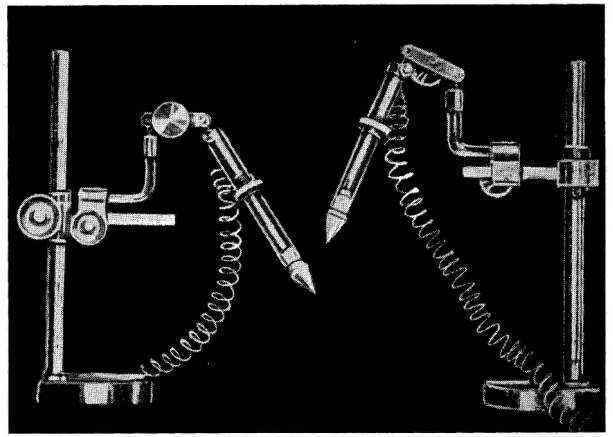
Le vrai découvreur du cortex électrique: Richard Caton (1842 – 1926)

RICHARD CATON IN HIS THIRTIES—AT THE PERIOD OF HIS WORK ON THE ELECTRICAL ACTIVITY OF THE BRAIN

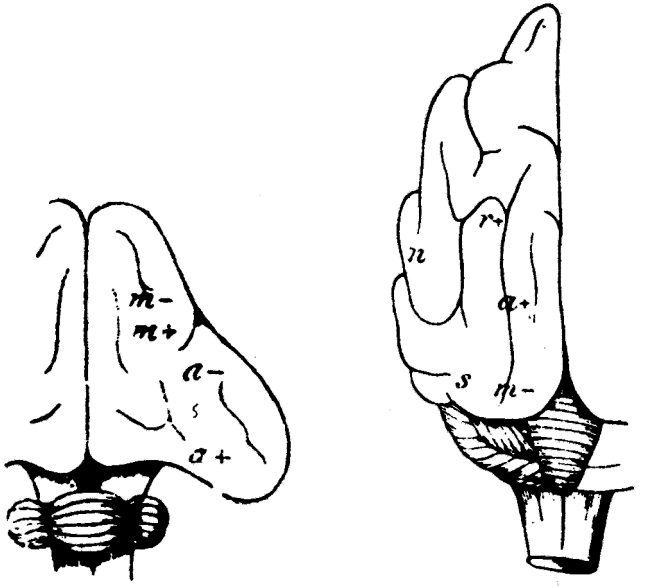
The Electric Currents of the Brain. By RICHARD CATON, M.D., Liverpool.—After a brief *résumé* of previous investigations, the author gave an account of his own experiments on the brains of the rabbit and the monkey. The following is a brief summary of the principal results. In every brain hitherto examined, the galvanometer has indicated the existence of electric currents. The external surface of the grey matter is usually positive in relation to the surface of a section through it. Feeble currents of varying direction pass through the multiplier when the electrodes are placed on two points of the external surface, or one electrode on the grey matter, and one on the surface of the skull. The electric currents of the grey matter appear to have a relation to its function. When any part of the grey matter is in a state of functional activity, its electric current usually exhibits negative variation. For example, on the areas shown by Dr. Ferrier to be related to rotation of the head and to mastication, negative variation of the current was observed to occur whenever those two acts respectively were performed. Impressions through the senses were found to influence the currents of certain areas; *e. g.*, the currents of that part of the rabbit's brain which Dr. Ferrier has shown to be related to movements of the eyelids, were found to be markedly influenced by stimulation of the opposite retina by light.

Adolf Beck (1863 – 1939): les potentiels spontanés et évoqués

Adolf Beck as a young man, at the period of his doctoral work on the electrical activity of the brain



The electrodes used by Beck for recording electrical potentials from the brain

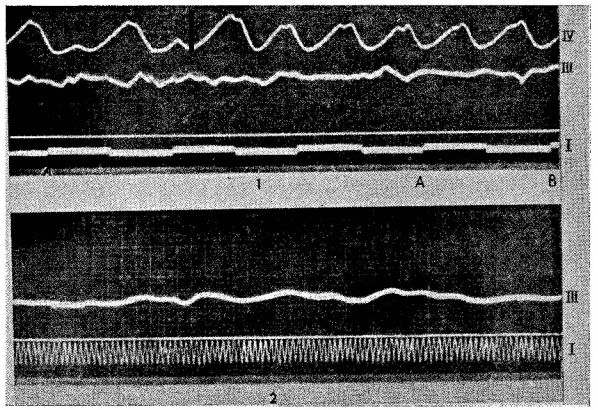


Napoléon Nicodemus Cybulski (1854 – 1919): les premiers enregistrements publiés

NAPOLEON NICODEMUS CYBULSKI (1854–1919) FROM THE EULOGY OF CYBULSKI BY BECK

(Courtesy of the University of Warsaw)

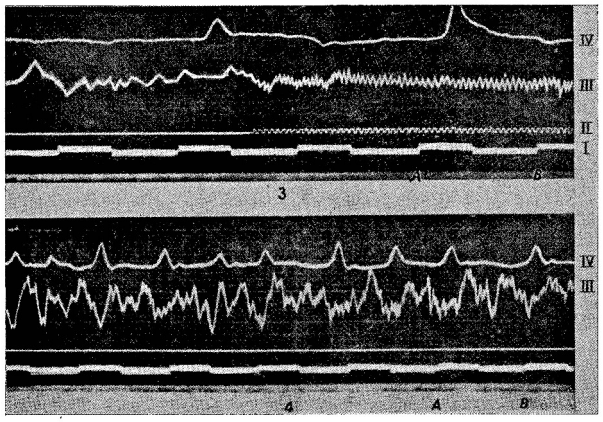
Norma



Chien

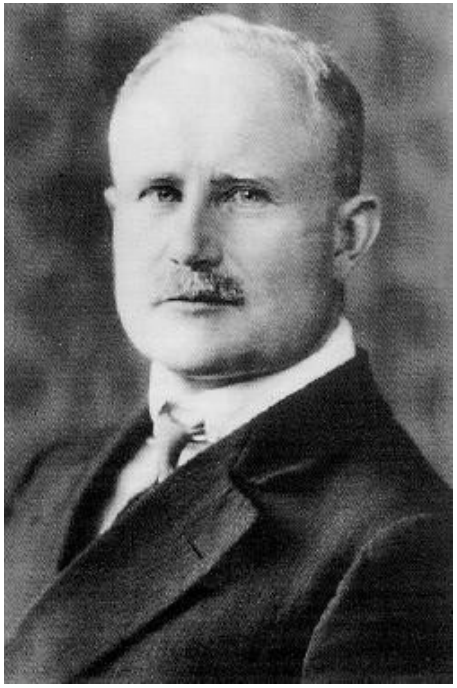
Singe

Crise induite

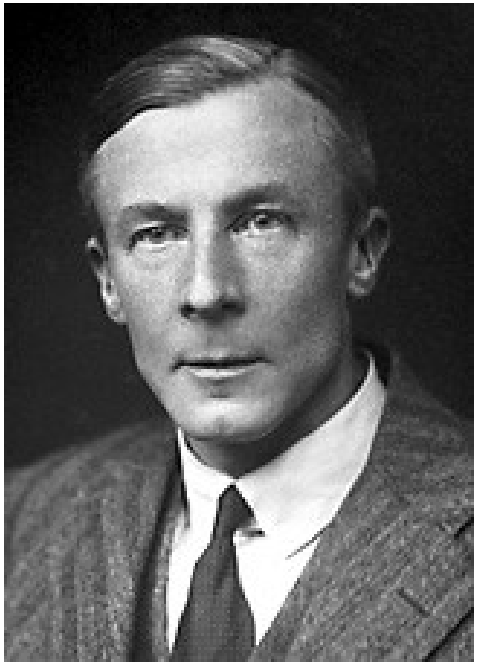


Chien

« Über Elektrenkephalogramm des Menschen »

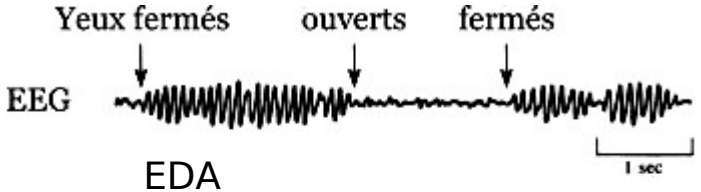


Hans Berger (1873-1941)

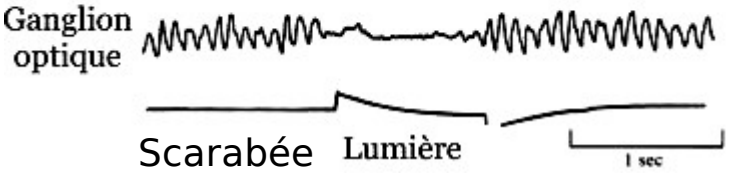


Lord Edgar D. Adrian (1889-1977)

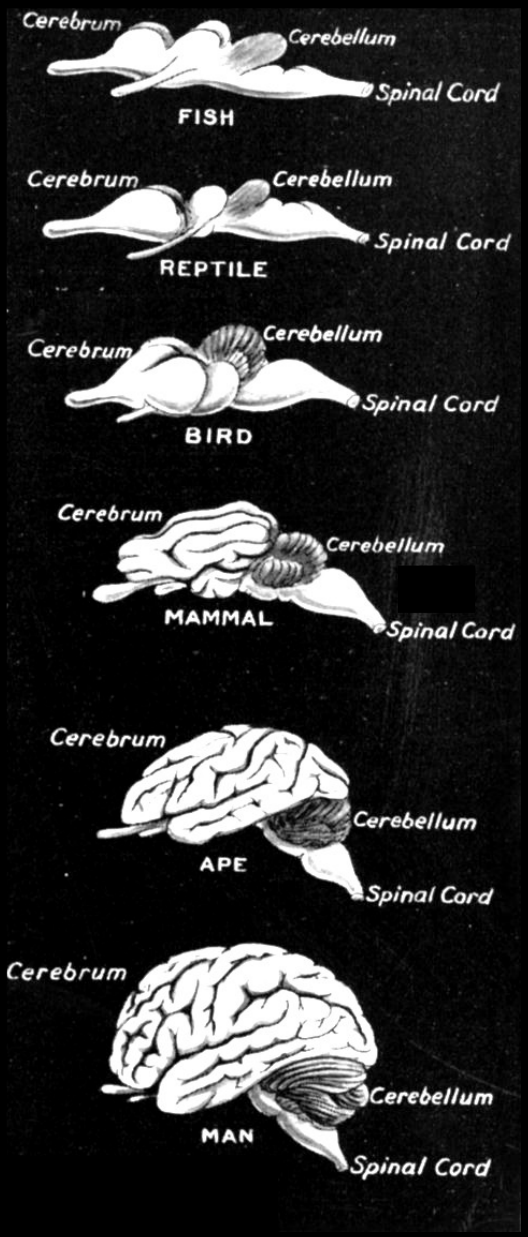
Premier EEG humain
1929

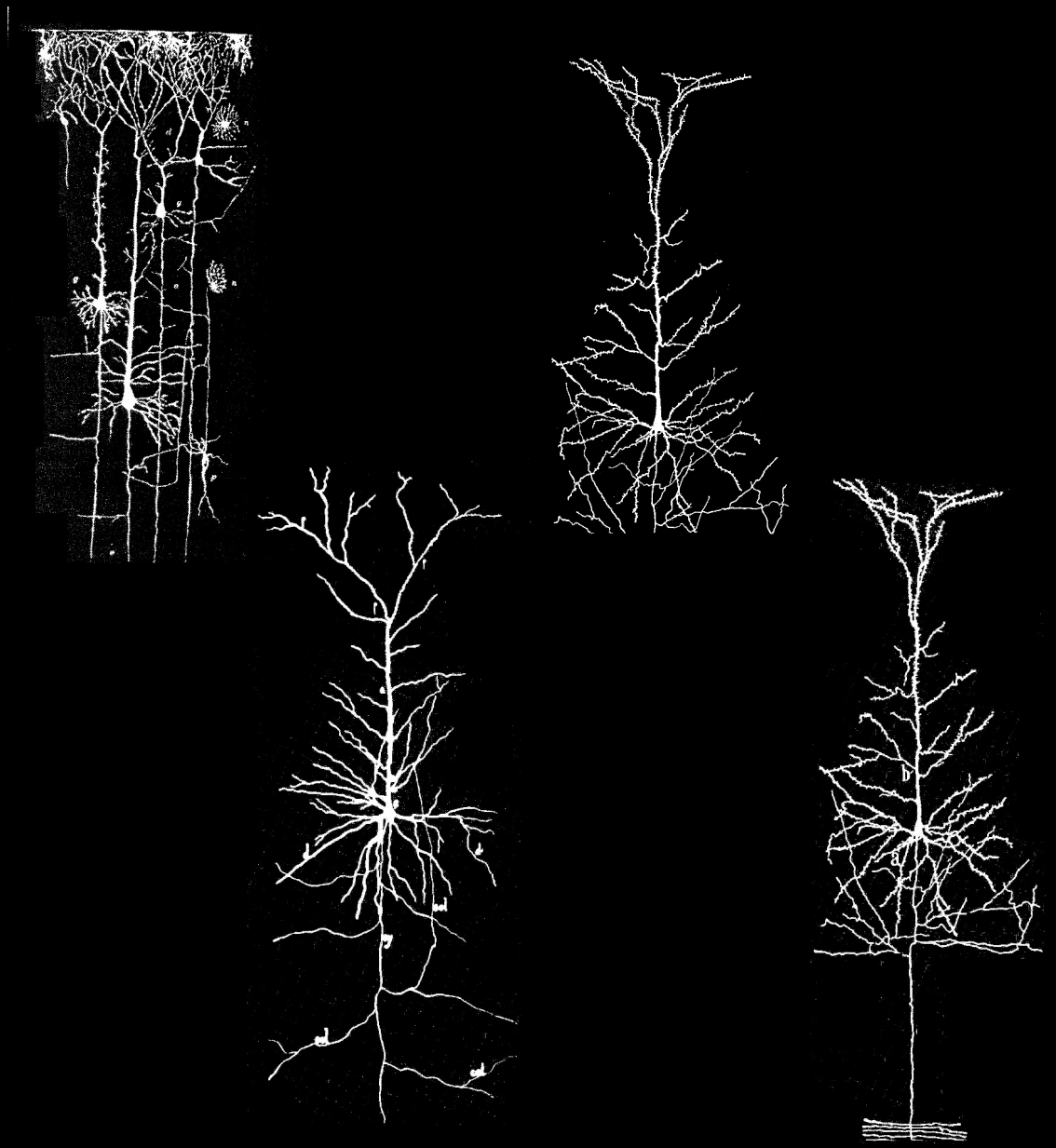


EDA



Conservation phylogénétique au niveau neuronal





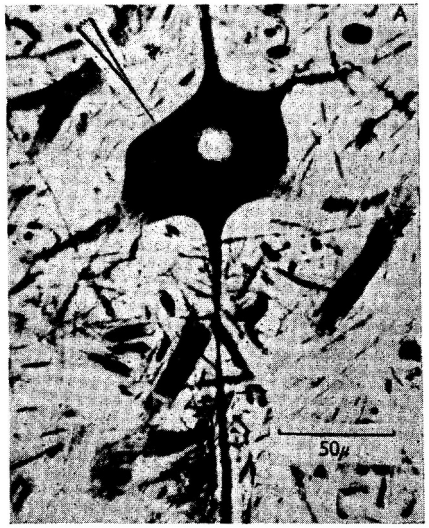
J. Physiol. (1952) 117, 431–460

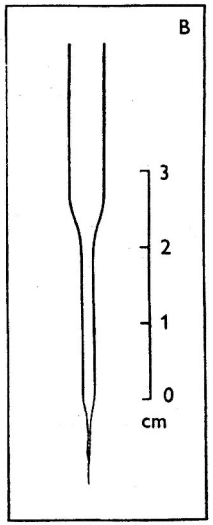
THE RECORDING OF POTENTIALS FROM MOTONEURONES WITH AN INTRACELLULAR ELECTRODE

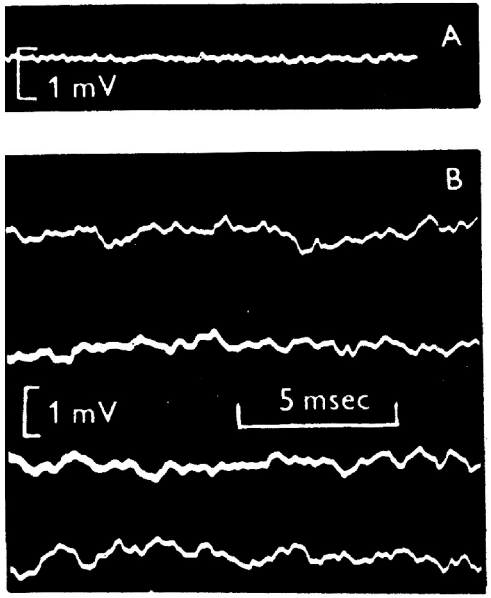
By L. G. BROCK, J. S. COOMBS and J. C. ECCLES

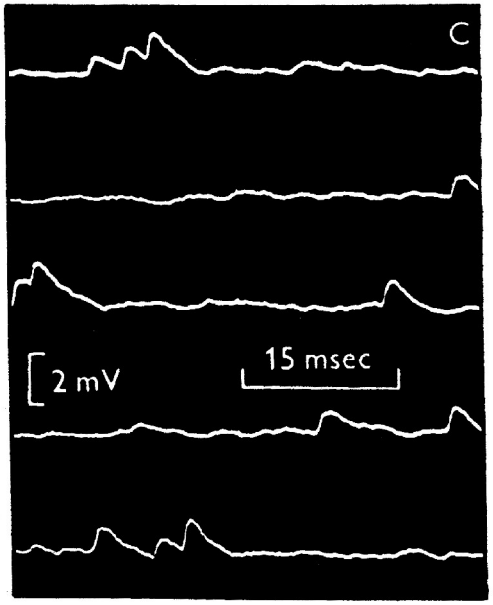
From the Departments of Physiology, University of Otago, Dunedin, and Australian National University, Canberra

(*Received* 13 *December* 1951)





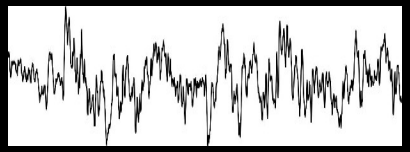




Electrogenèse corticale

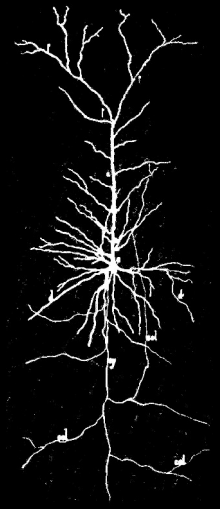
Cerveau

EEG

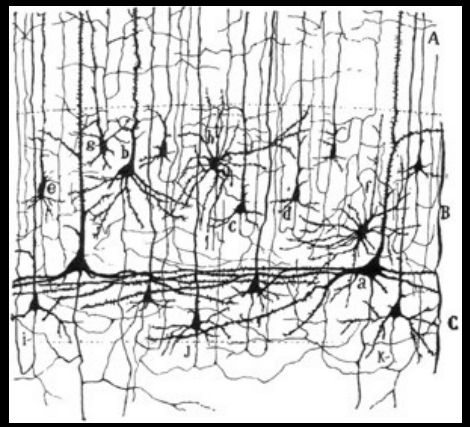


Etats cérébraux

?



Neurone



Réseau local

Organisation anatomo-fonctionnelle du néocortex: Organisation lamellaire

I The plexiform (or molecular) layer contains a feltwork of horizontally running axons and dendrites, the relatively rare Cajal-Retzius cells, and a poorly defined class of small nonspiny, nonpyramidal cells.

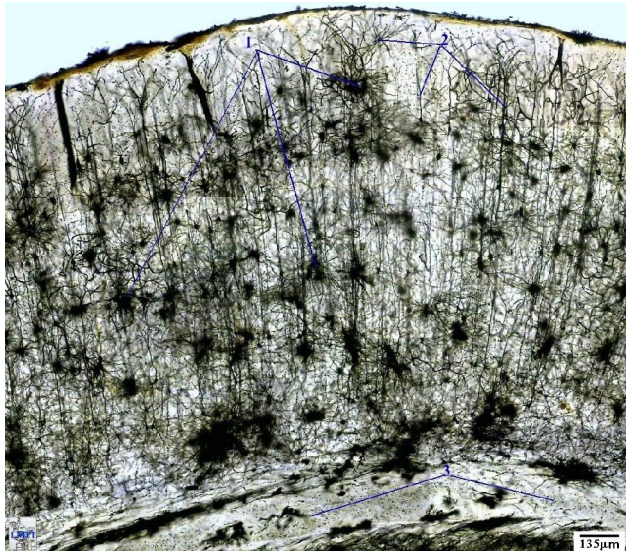
II The layer of small pyramids (or corpuscular layer); it also contains many nonpyramidal cells, such as the small basket cells.

III The layer of medium-sized pyramids (or simply the pyramidal layer), in a gradual transition from layer II; it also contains many nonspiny, nonpyramidal cells—the large basket cells, the chandelier cells, the double bouquet cells.

IV The granular layer contains many small neurons, cell bodies that are tightly packed in a narrow layer, including the spiny, nonpyramidal cells, neurogliofarm cells, and others.

V The layer of large pyramidal cells (or ganglionic layer).

VI The layer of pleomorphic cells, sometimes called the "multiform," or "spindle" layer, contains cells of varying morphology: regular and inverted pyramids, Martinotti cells, etc.

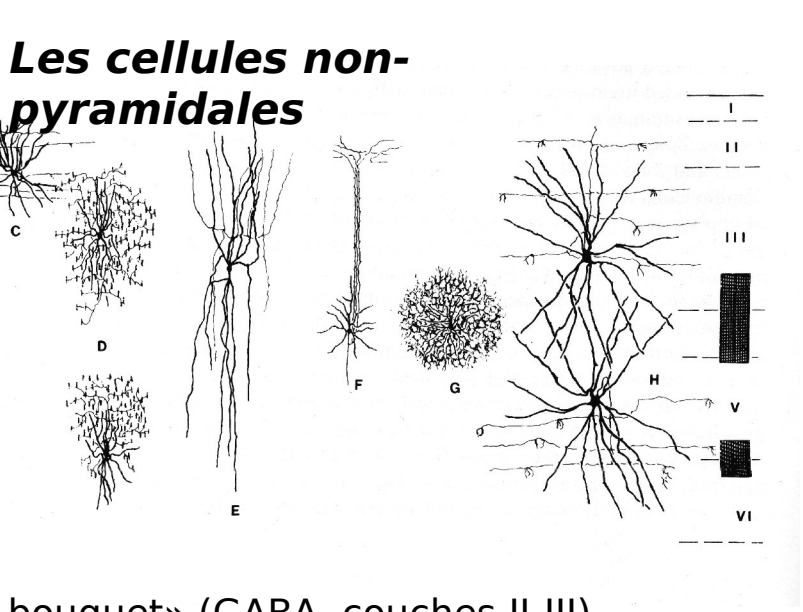


Organisation anatomo-fonctionnelle du néocortex: typologie cellulaire

27.10^9 neurones dans le cortex humain
400.10^6 connexions synaptiques par mm^3 de cortex

***La cellule pyramidale**: Le neurone de sortie*
(toutes les couches sauf I, 70-80%, Glu)

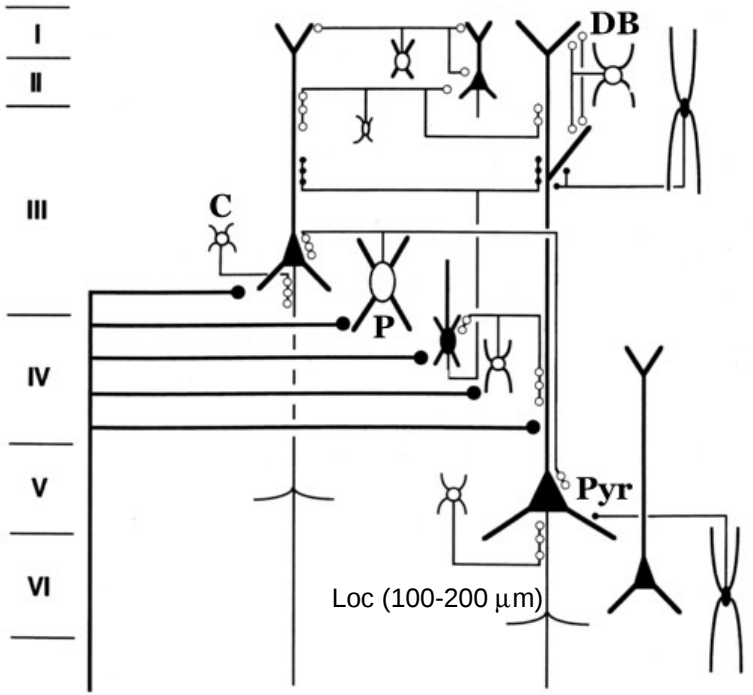
(4000 à 20000 contacts synaptiques/Pyr)



Les cellules non-pyramidales

B: «Double bouquet» (GABA, couches II-III)
F: Neurones épineux non pyramidaux (intern Glu, 2-3%, couches III-IV)
H: « Basket cells » (GABA, 20%, toutes les couches: III, IV, V, projections horizontales(1mm))
G: Neurogliaform (peptides)

Organisation anatomo-fonctionnelle du néocortex: Circuits locaux et projections des cellules pyramidales



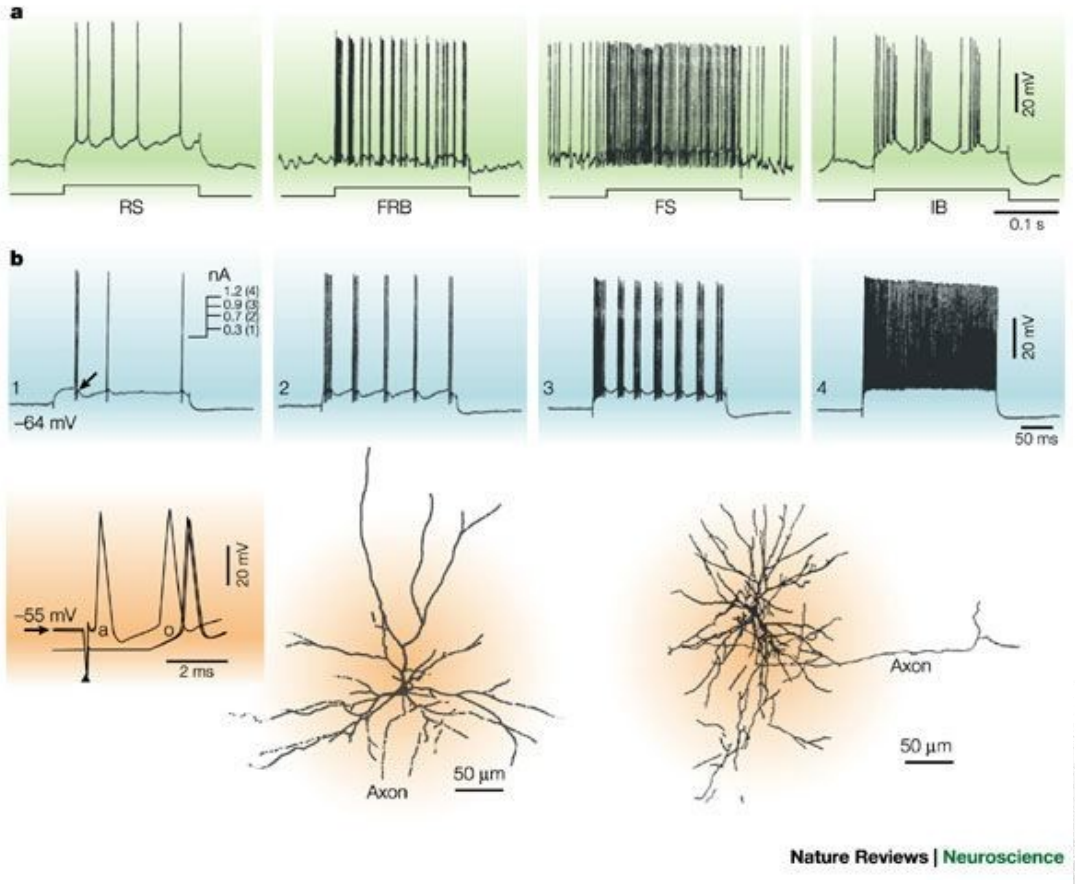
Synapses excitatrices (asymétriques) 75-80%
Synapses inhibitrices (symétriques) 20-25%

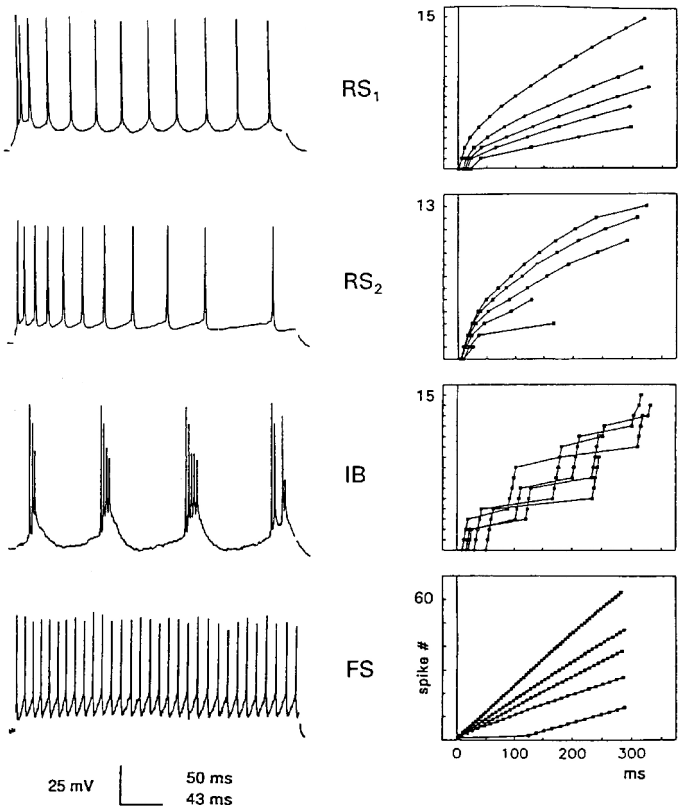
Table 3-2. External targets of neocortical pyramidal cells with projecting axons (from Jones, 1984b).

Source	Targets
Layer II	Ipsilateral cortical areas
Layer III	Contralateral cortical areas
Layer IV	Generally none*
Layer V	Spinal cord, pons, medulla, midbrain, generalized thalamic nuclei, basal ganglia
Layer VI	Principal thalamic, nuclei Claustrum

*Area 17 contains some neurons in Layer IV whose axons project to other cortical areas.

Electrogenèse néocorticale: Typologie électrophysiologique



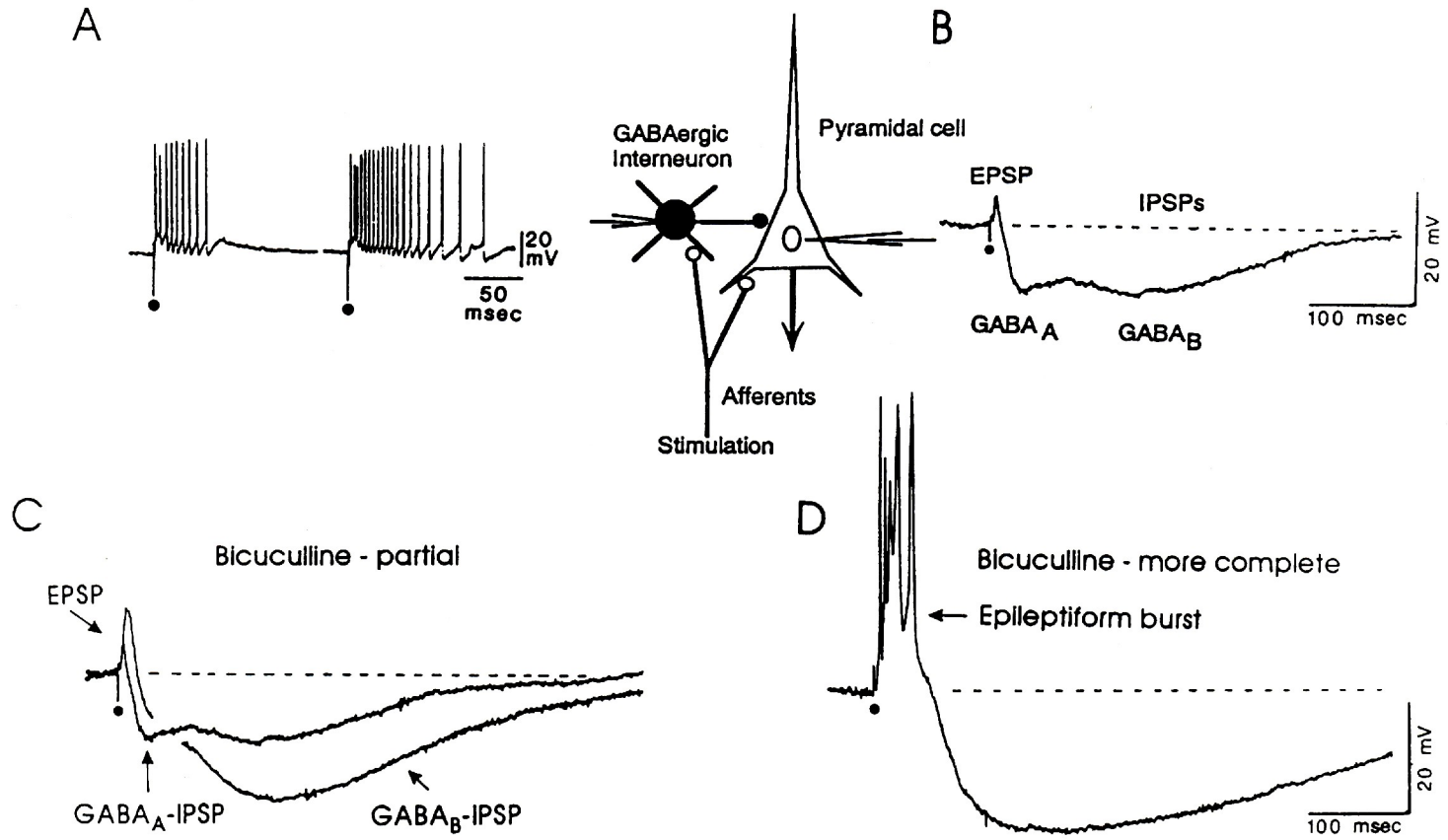


RS: la plupart des neurones pyramidaux
FRB: pyramidales et basket (clusters 300-600 Hz/30-50 Hz)
IB: pyramidales (inactivation sodiques)
FS: int. Inhibiteurs (pas d'inactivation sodique)

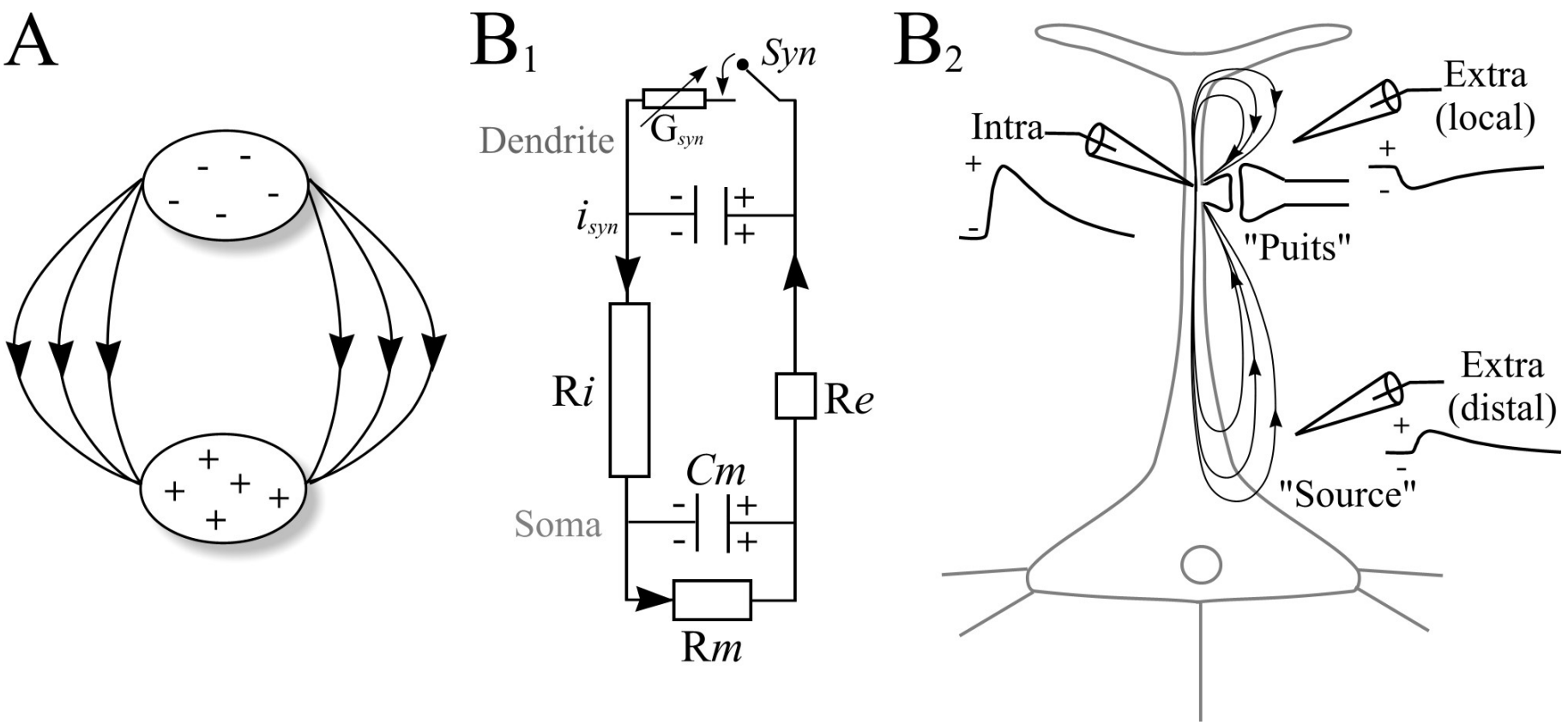
Electrogenèse néocorticale: Transmission synaptique: Glu + GABA

Isyn = Gsyn (Vm – Esyn)

Vsyn = Isyn / Gm

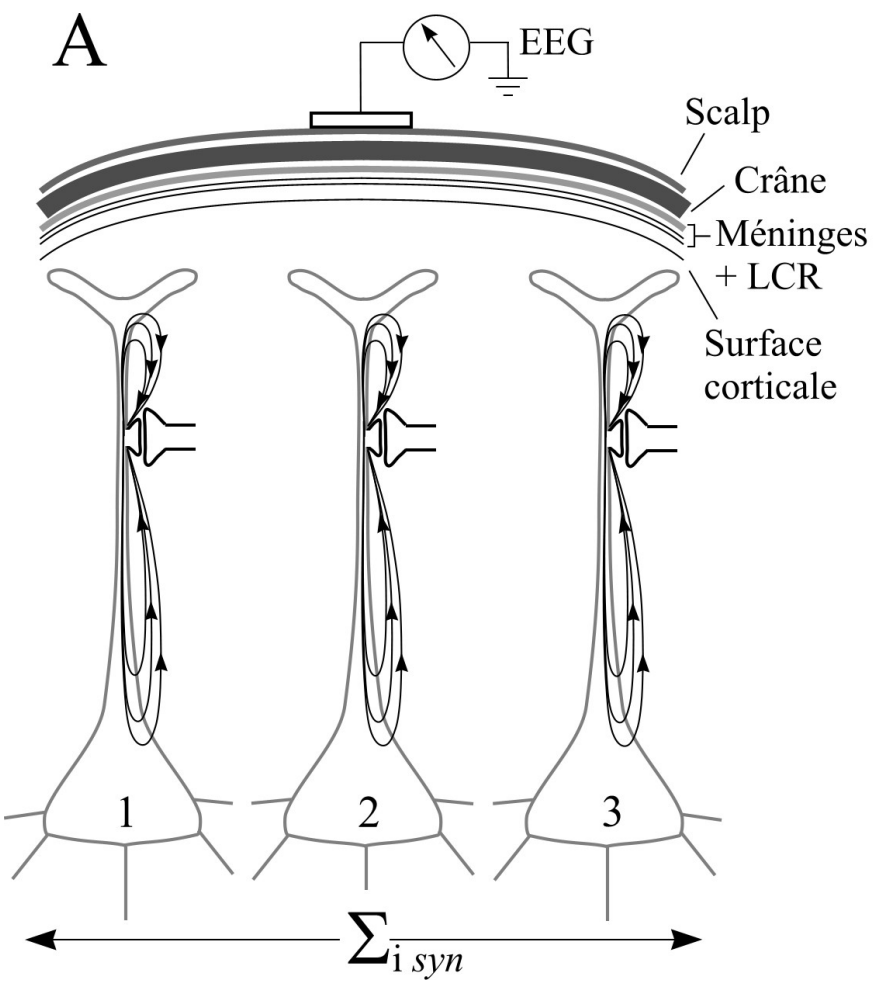


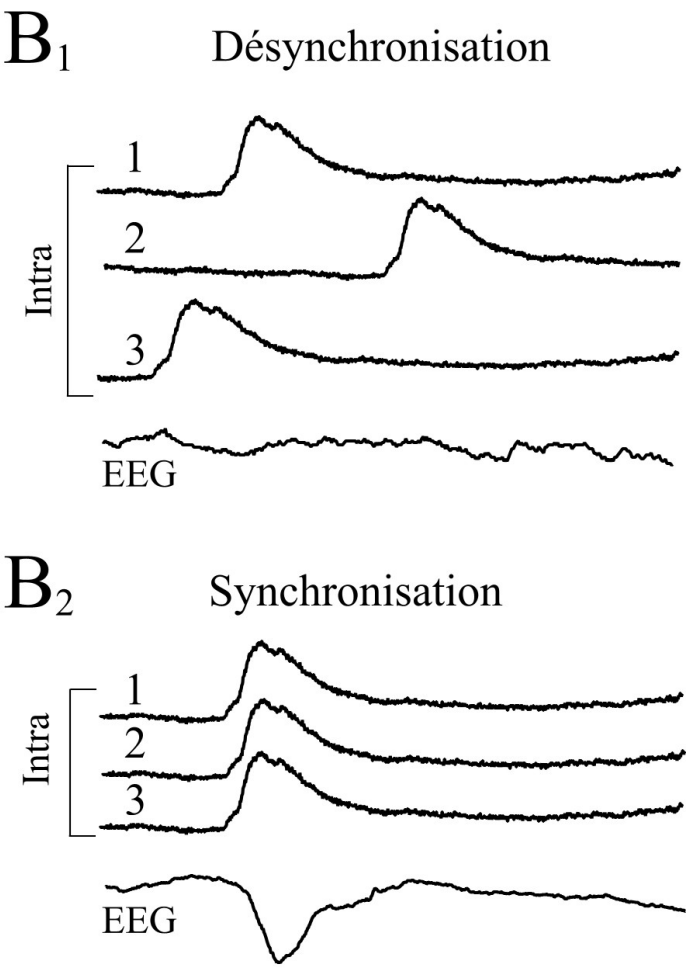
Electrogenèse néocorticale: EEG et le modèle du dipôle



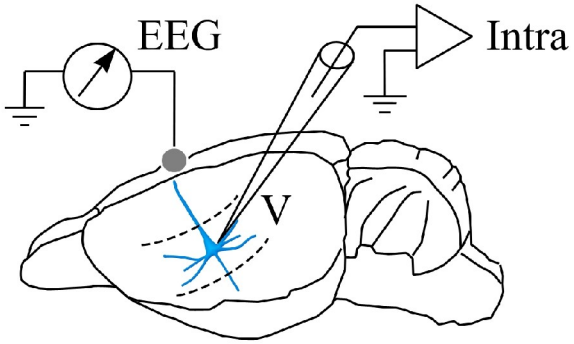
$\Delta Vintra = Isyn\ [Rm + Rext] >> \Delta Vextra = Isyn\ [Rext]$

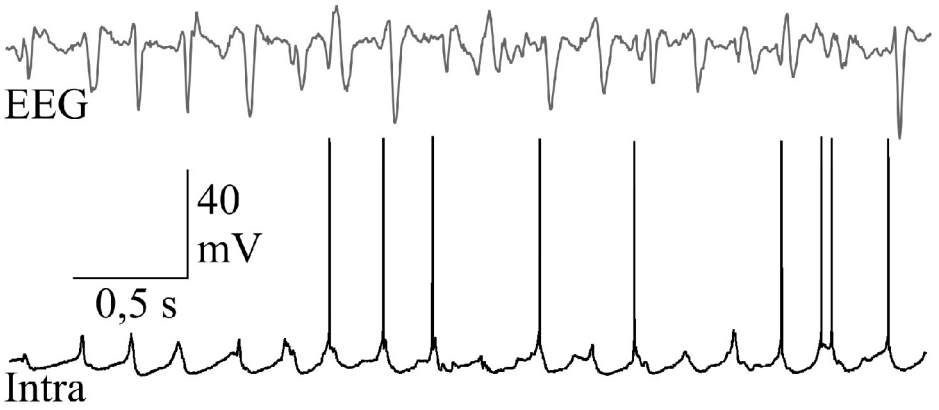
Electrogenèse néocorticale: EEG et synchronisation synaptique

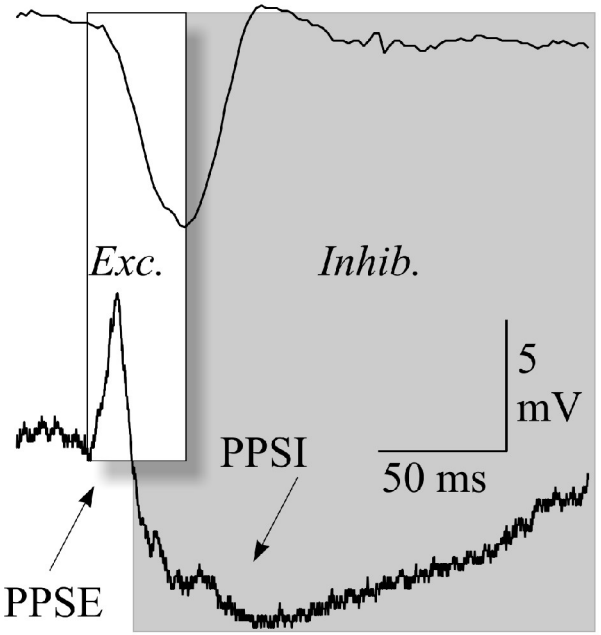


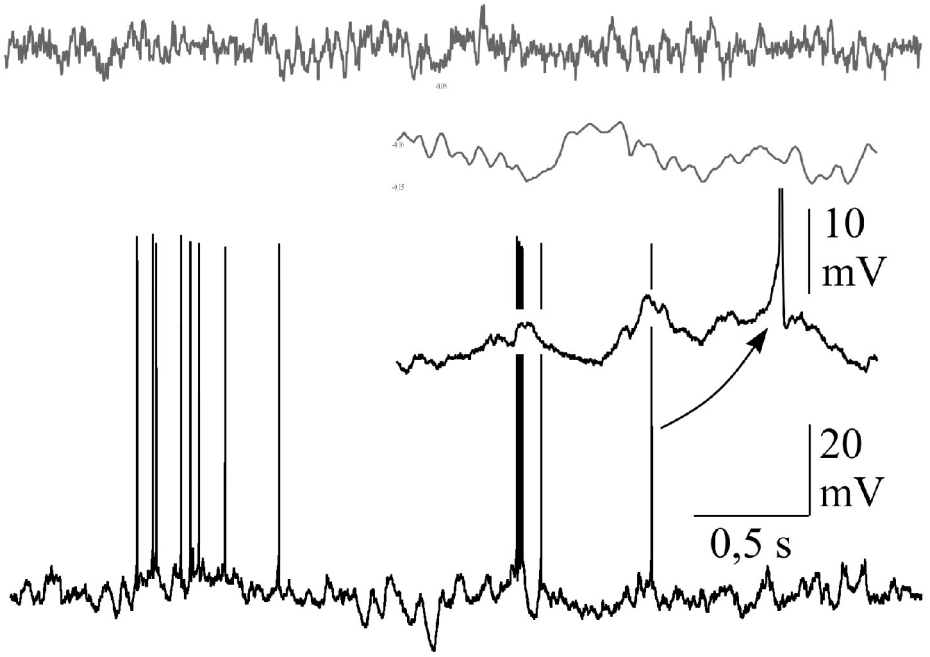


Electrogenèse néocorticale: EEG et corrélation intracellulaire





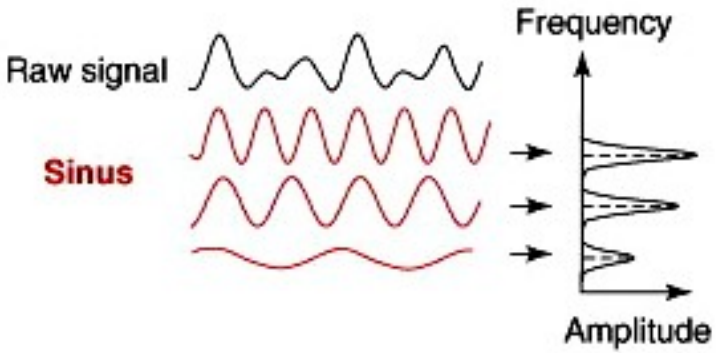




Méthodes d'analyses des fréquences des signaux EEG

Transformées de Fourier

$$f(t) = a_0 + \sum_{n=1}^{+\infty} a_n \cos n\omega t + b_n \sin n\omega t$$



« Ondelettes »: Représentation « temps-fréquence »

« Glissement » et mesure niveau de superposition