

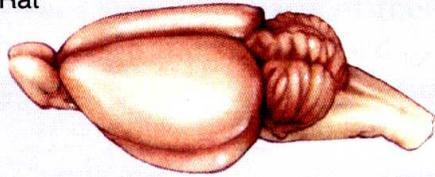
Vorlesungsteil Neurobiophysik

- Ganz kurze Einführung in die Anatomie des Nervensystems.
- Wie ist eine Nervenzelle prinzipiell aufgebaut?
- Wie entsteht in Nervenzellen elektrische Spannung?
- Wie kommunizieren Nervenzellen elektrisch miteinander?
- Was ist das Aktionspotential?
- Wie leiten Nerven Informationen?
- Wie funktioniert eigentlich ein Muskel?
- Wie werden Muskeln durch Nerven angesteuert?
- Wie sind Nervenzellen miteinander zu logischen Schaltkreisen verbunden?
- Was sind Biosignale? Was sagen sie aus? (Herzgeräusche, EKG, EEG, MEG)

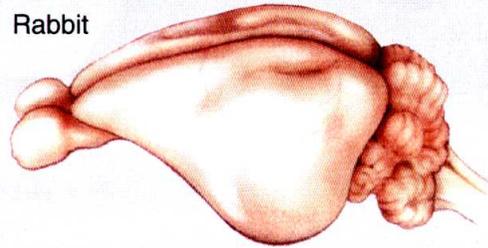
Kurze Einführung in die Neuroanatomie

~ 1 cm

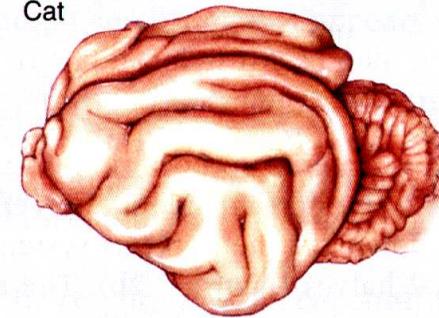
Rat



Rabbit

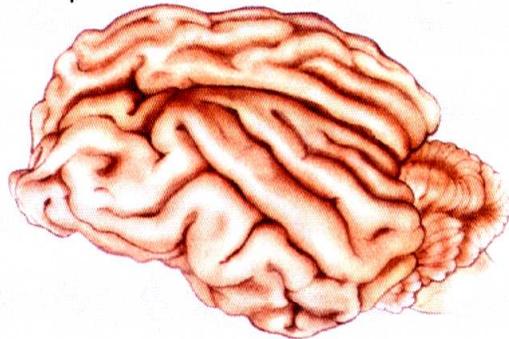


Cat

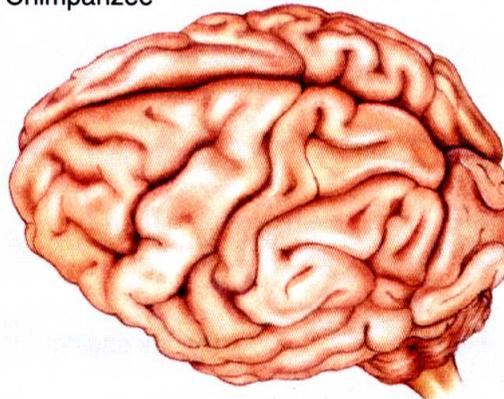


ca. 10 Millionen Neurone,
ca. 8000 Synapsen/Neuron

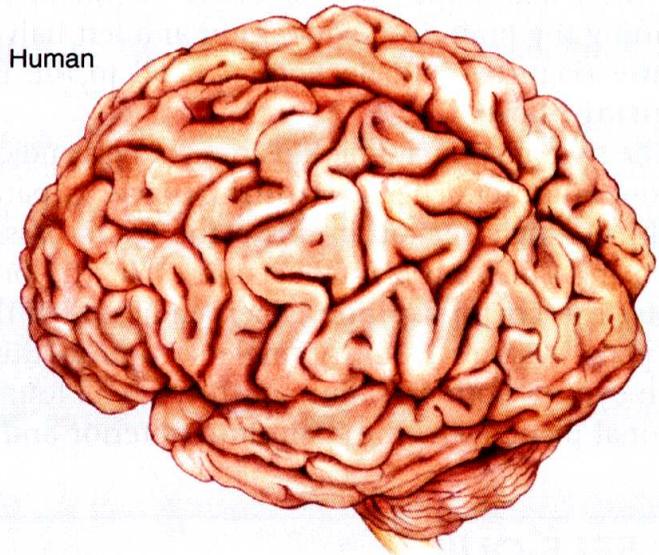
Sheep



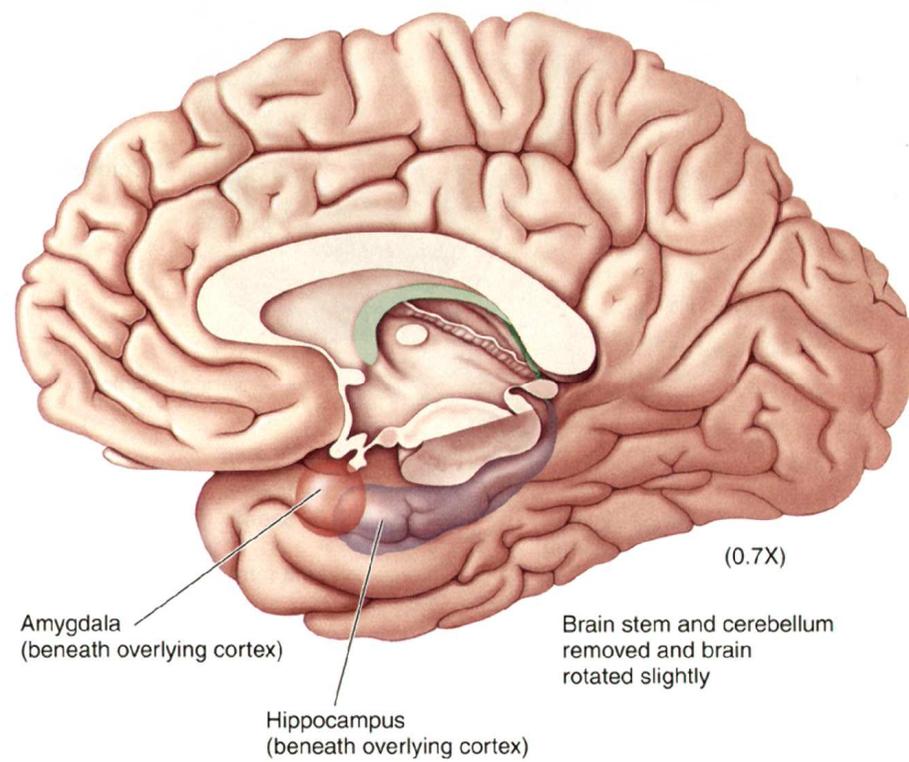
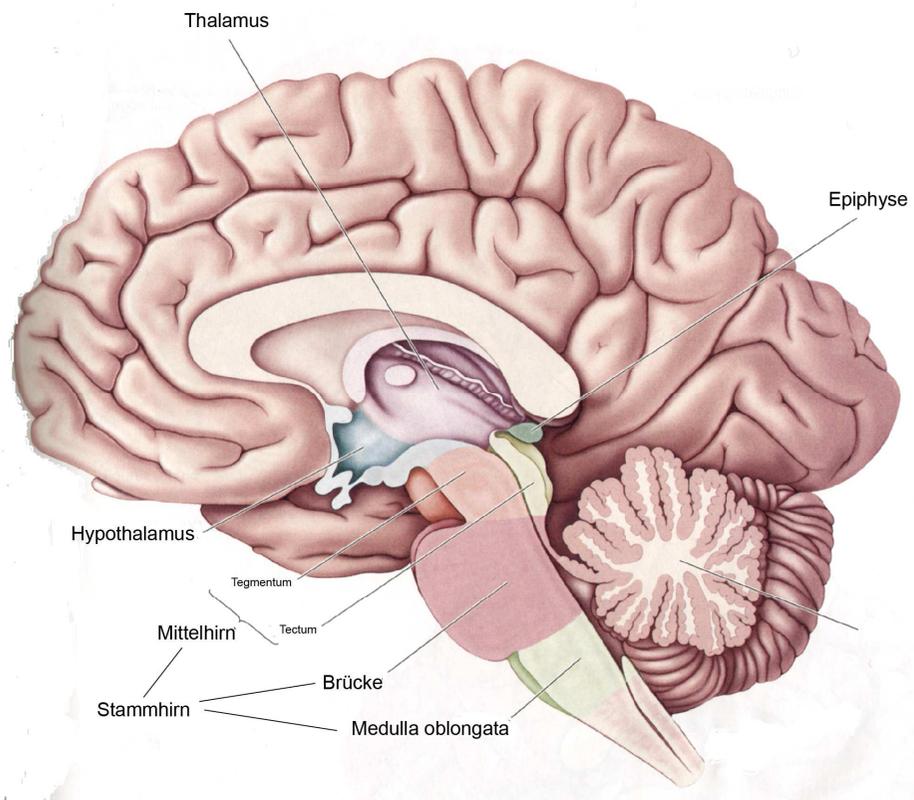
Chimpanzee

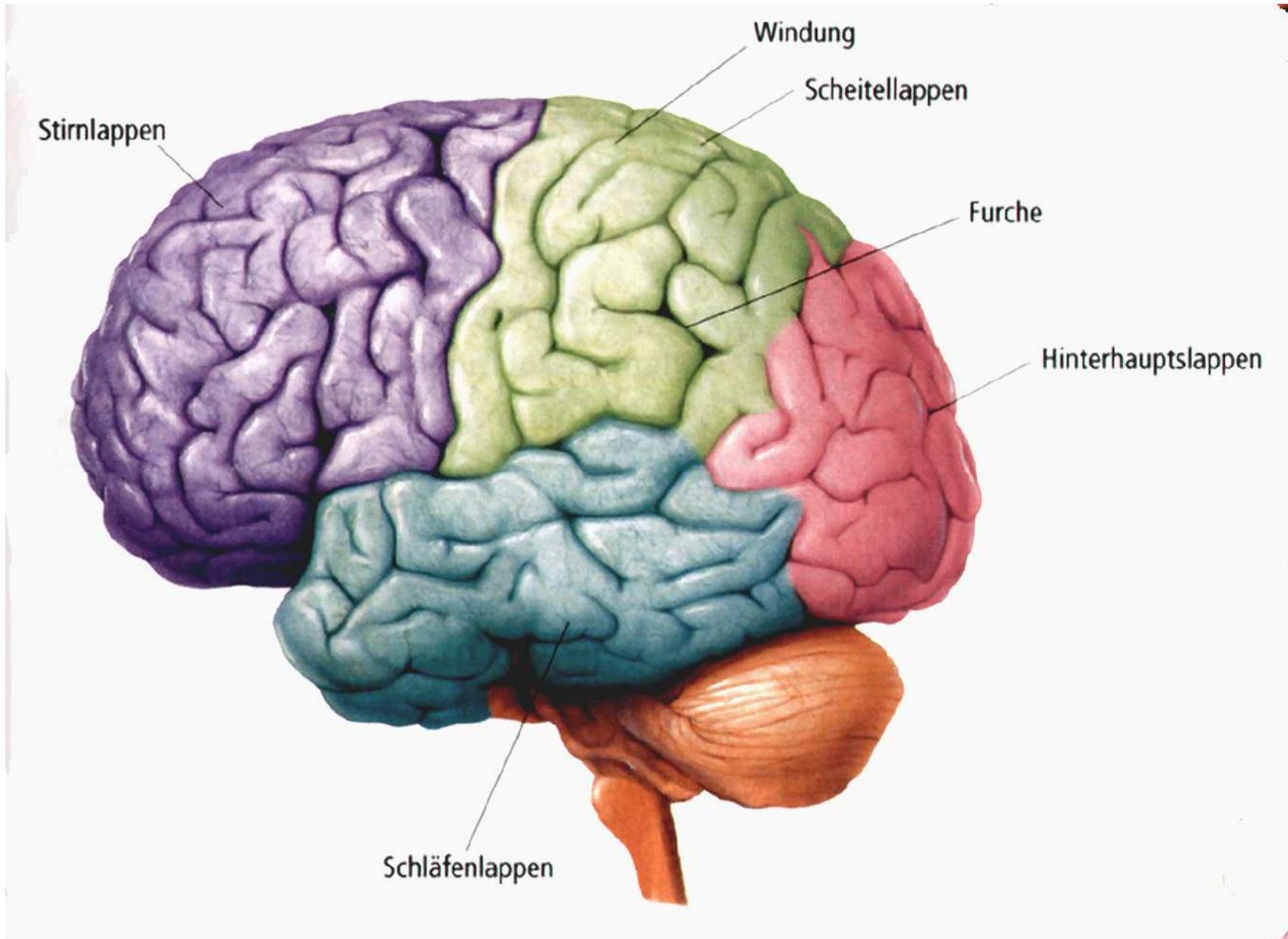


Human



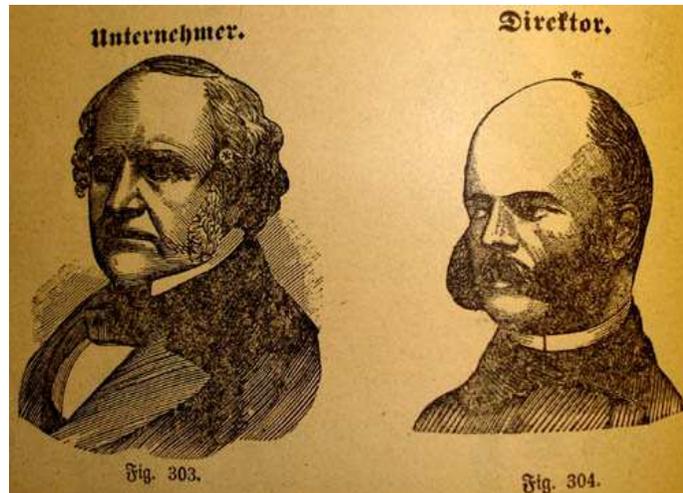
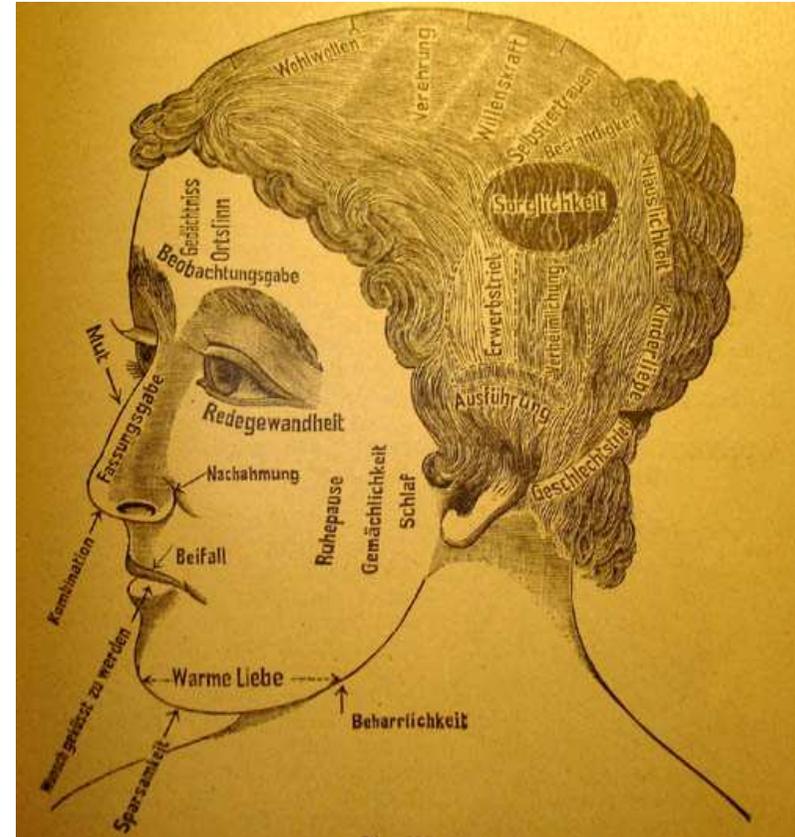
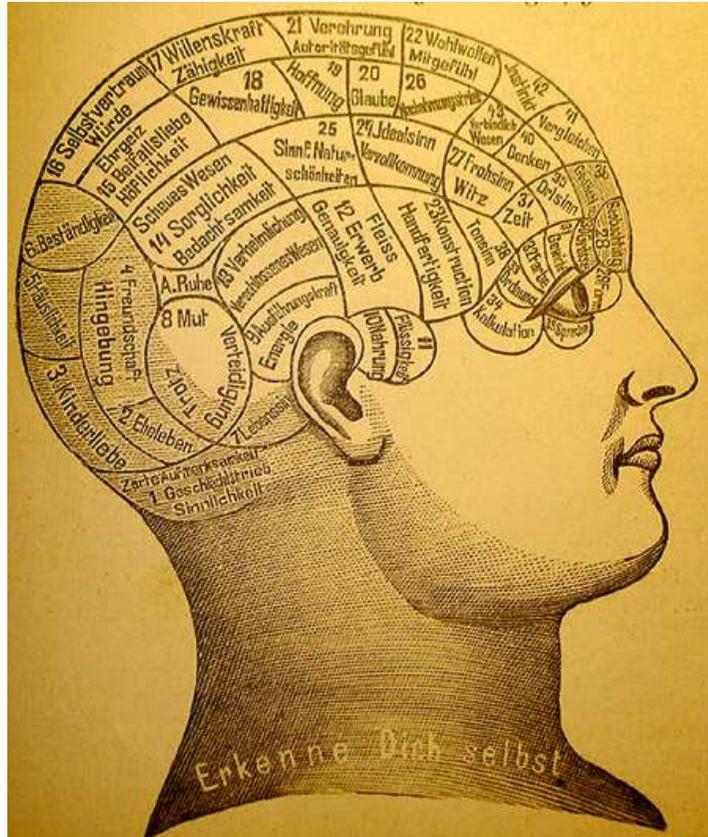
100 Milliarden Neurone,
ca. 1000 Synapsen/Neuron

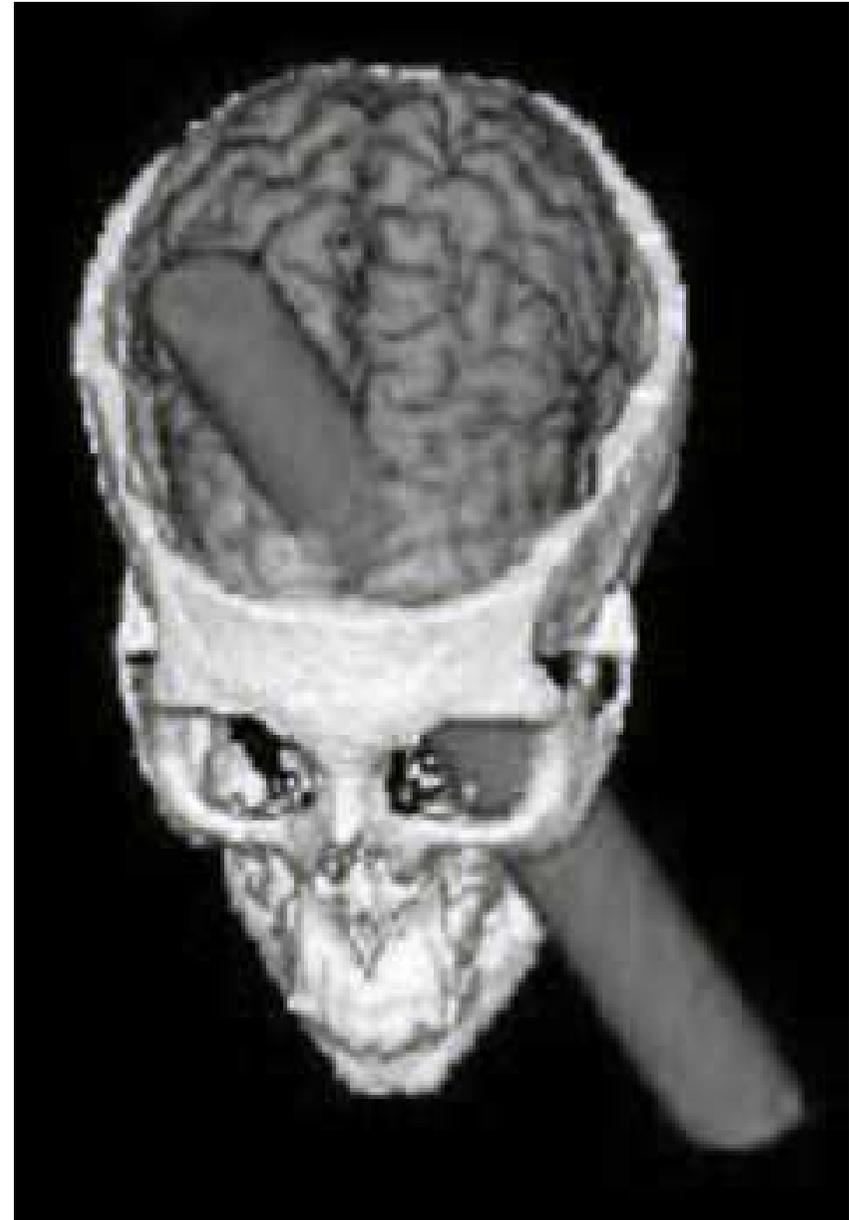
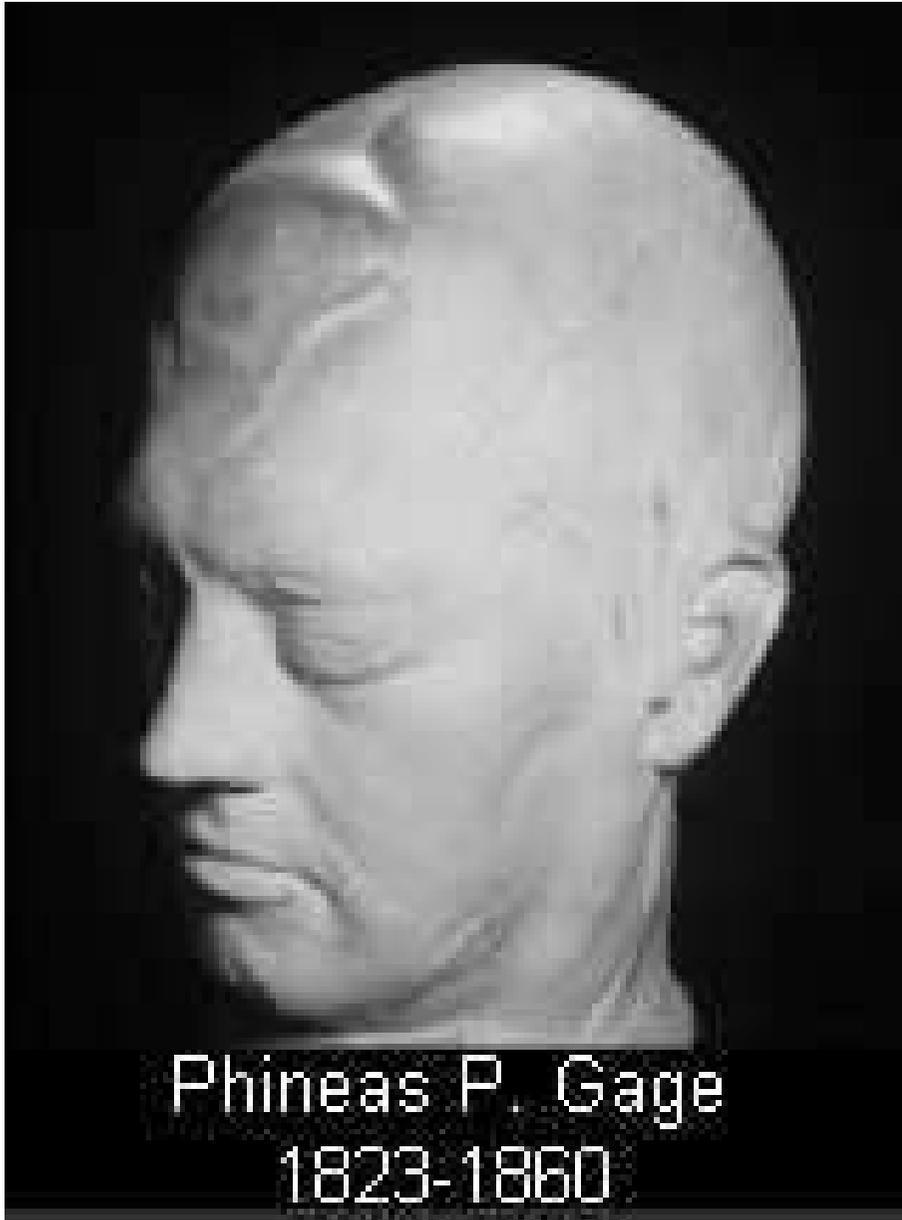


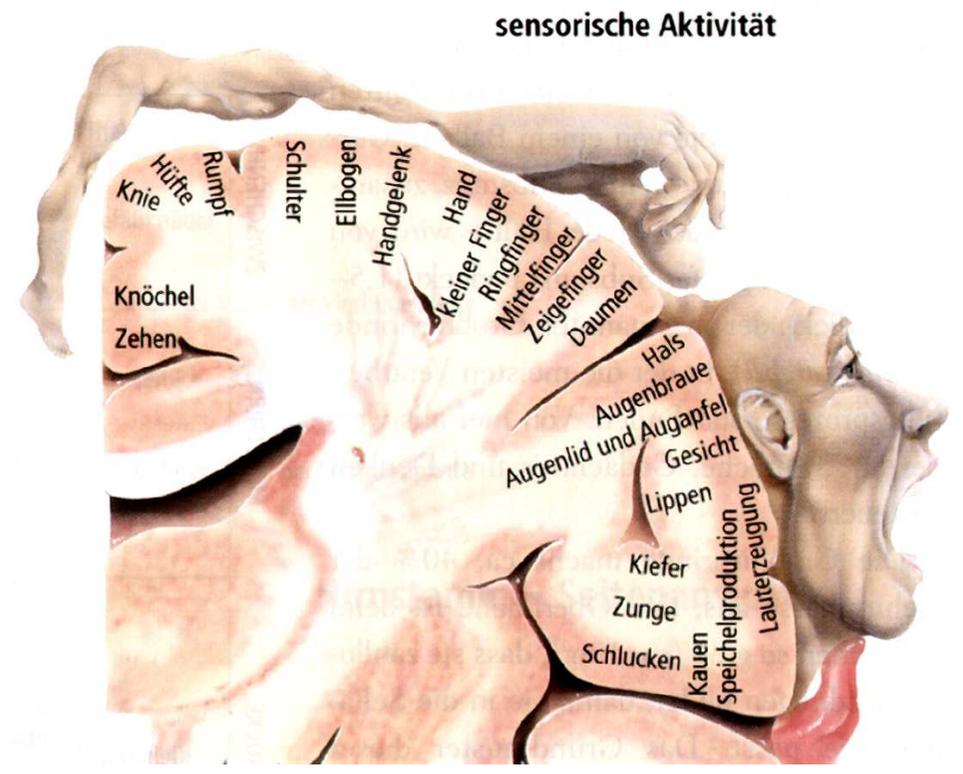
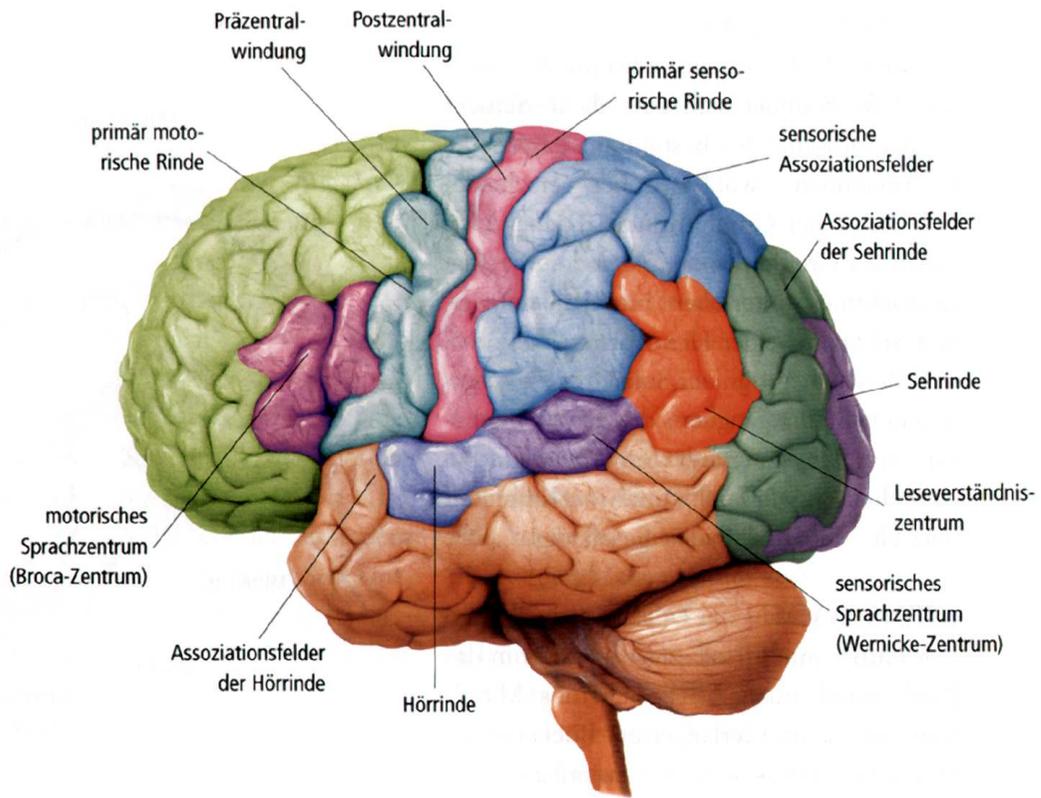


Bereiche der Großhirnrinde, Abbildung aus „Anatomica, Körper und Gesundheit“

Franz Josef Gall 1758-1828

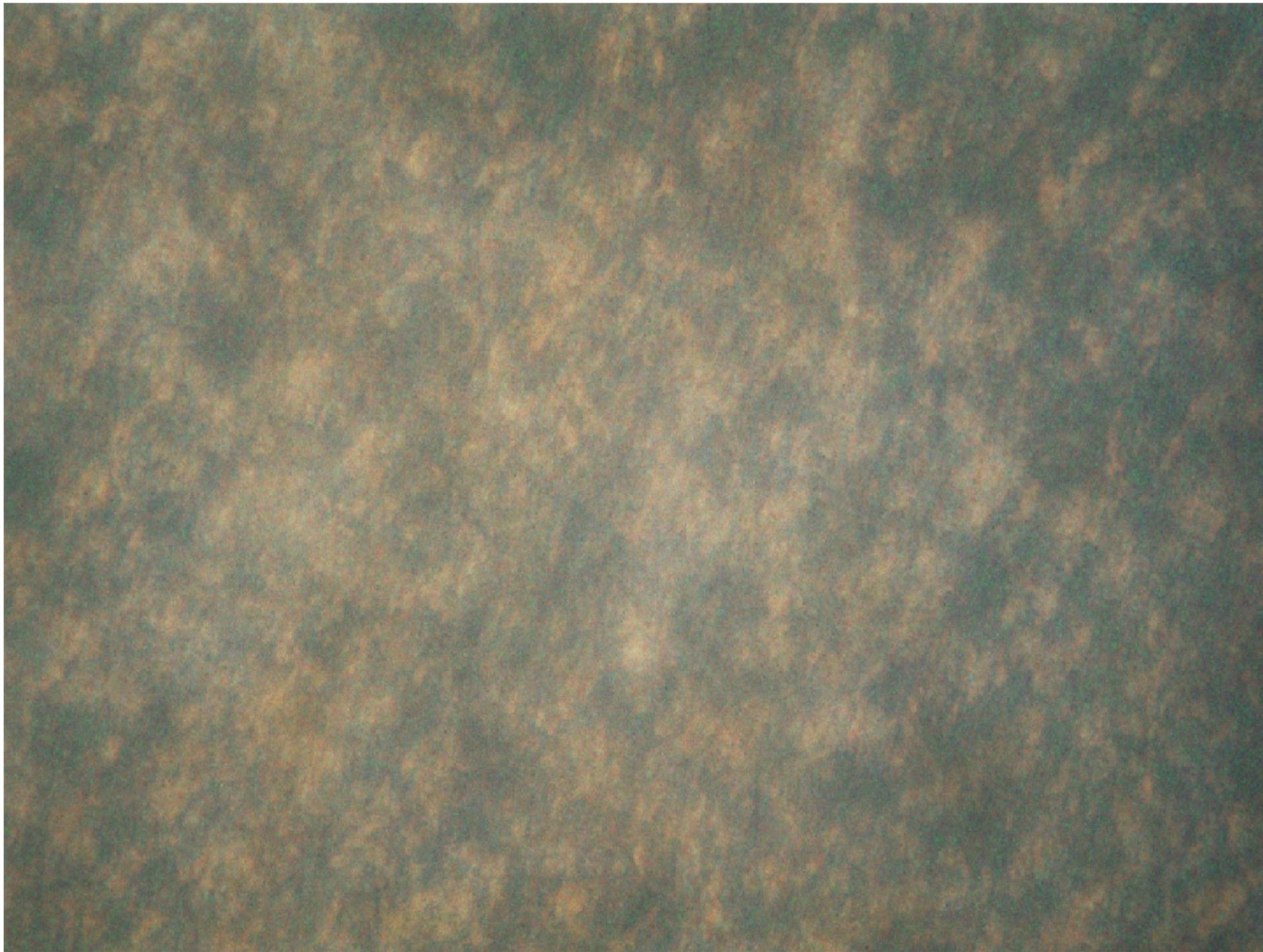






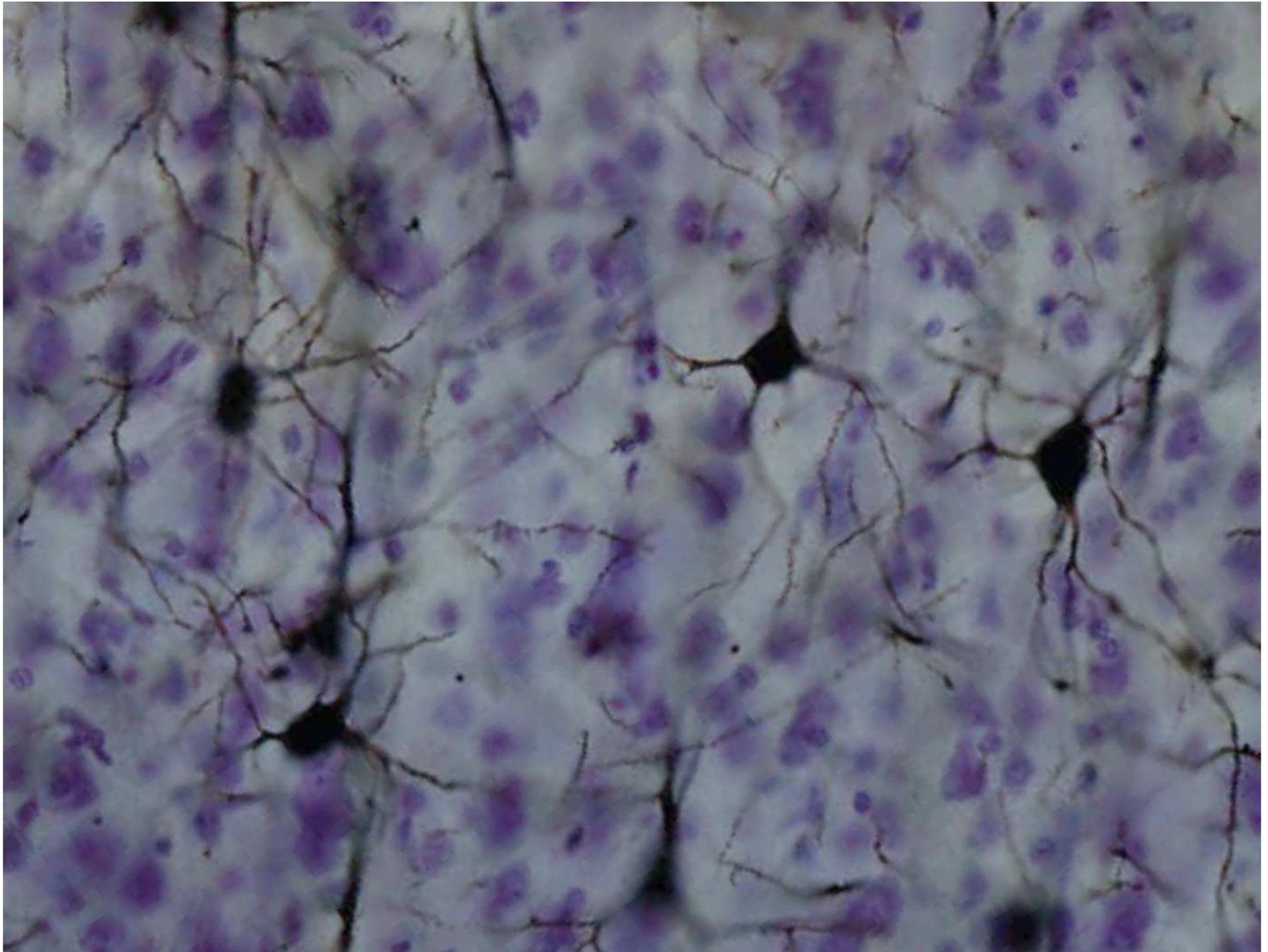
Funktionelle Organisation des Cortex, Abbildungen aus „Anatomica, Körper und Gesundheit“

Bau einer Nervenzelle





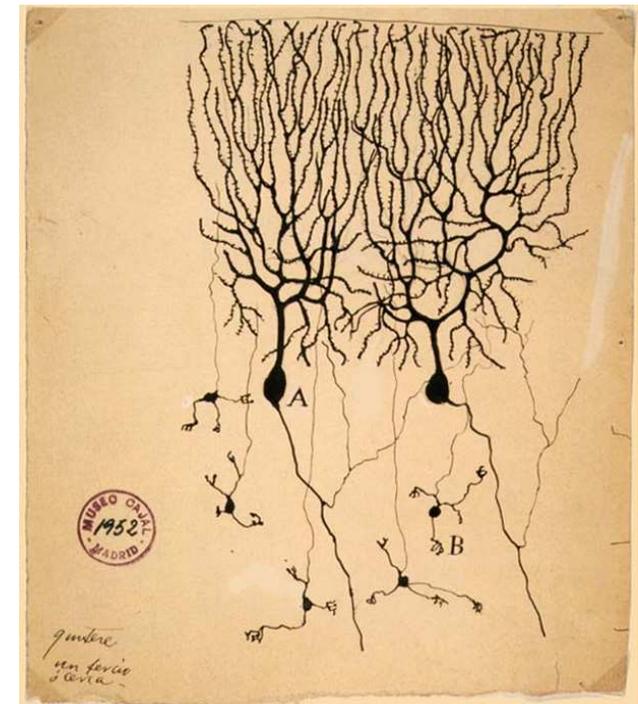
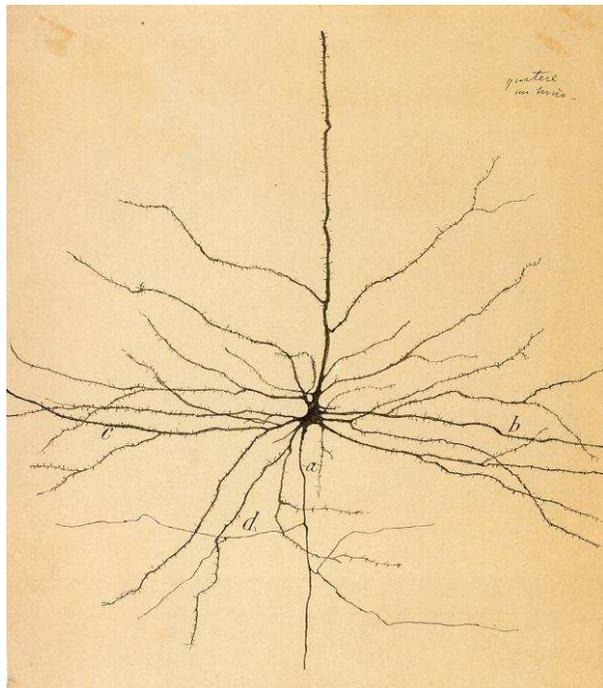
Camillo Golgi, 1843 – 1926, gelang erstmals die Sichtbarmachung einzelner Nervenzellen im Gehirn mittels Silbernitratfärbung.



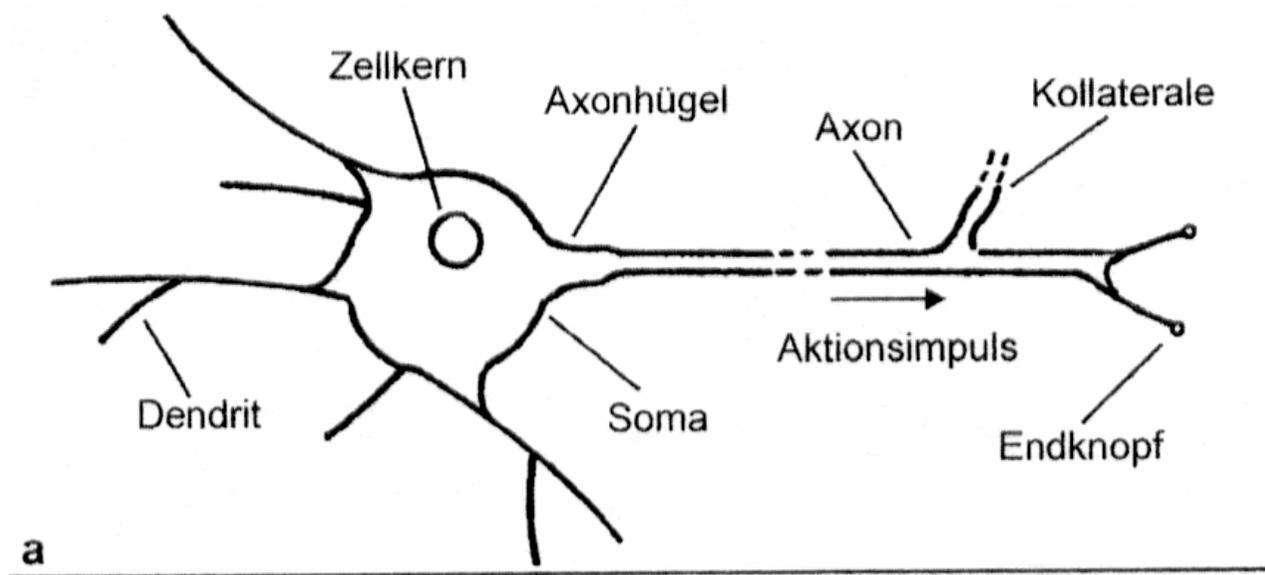
Pyramidenneuronen im somatosensorischen Cortex eines Makkaken (Golgi-Färbung), copyright freie Abbildung aus dem Internet



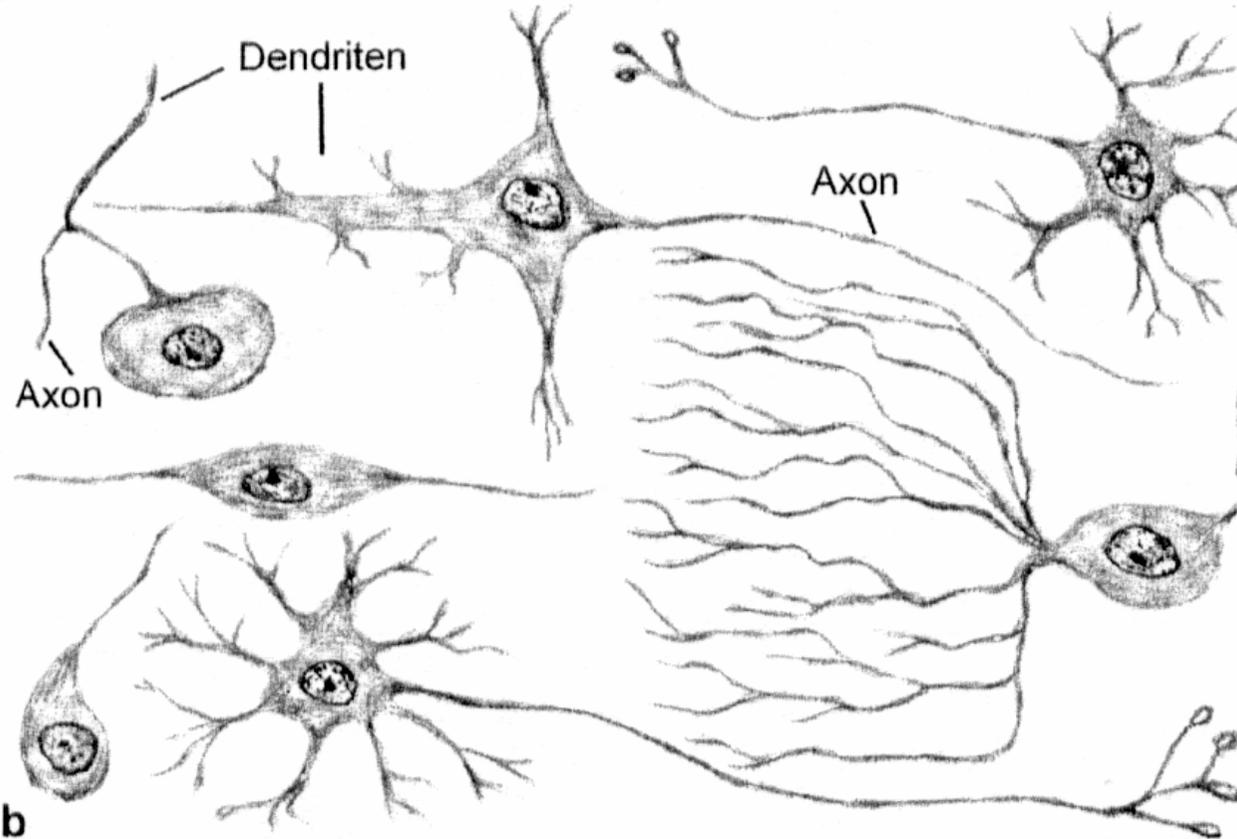
Ramon y Cayal, 1852 – 1934



Ramón y Cajal, Abbildungen aus „Wikipedia“

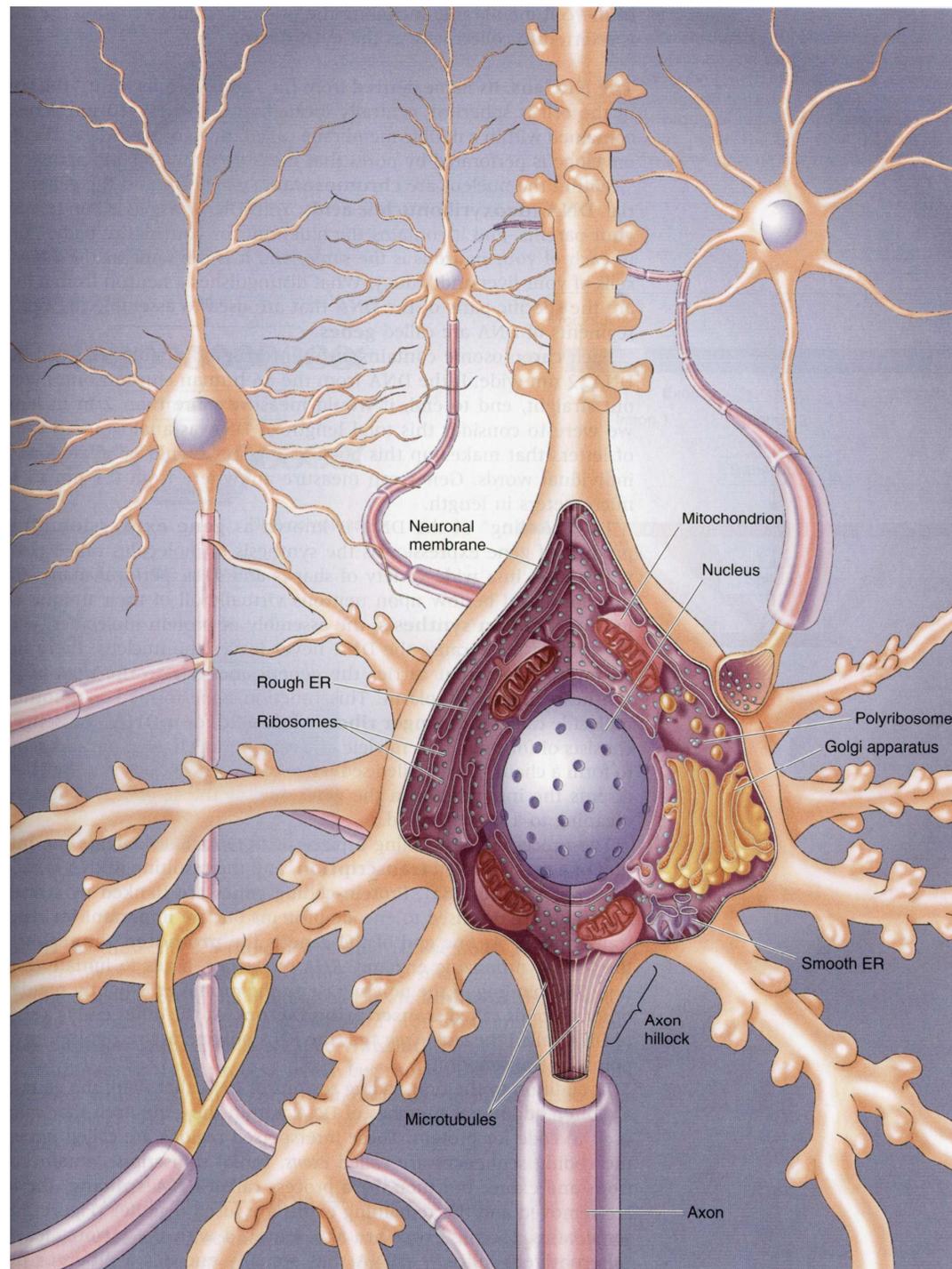


a

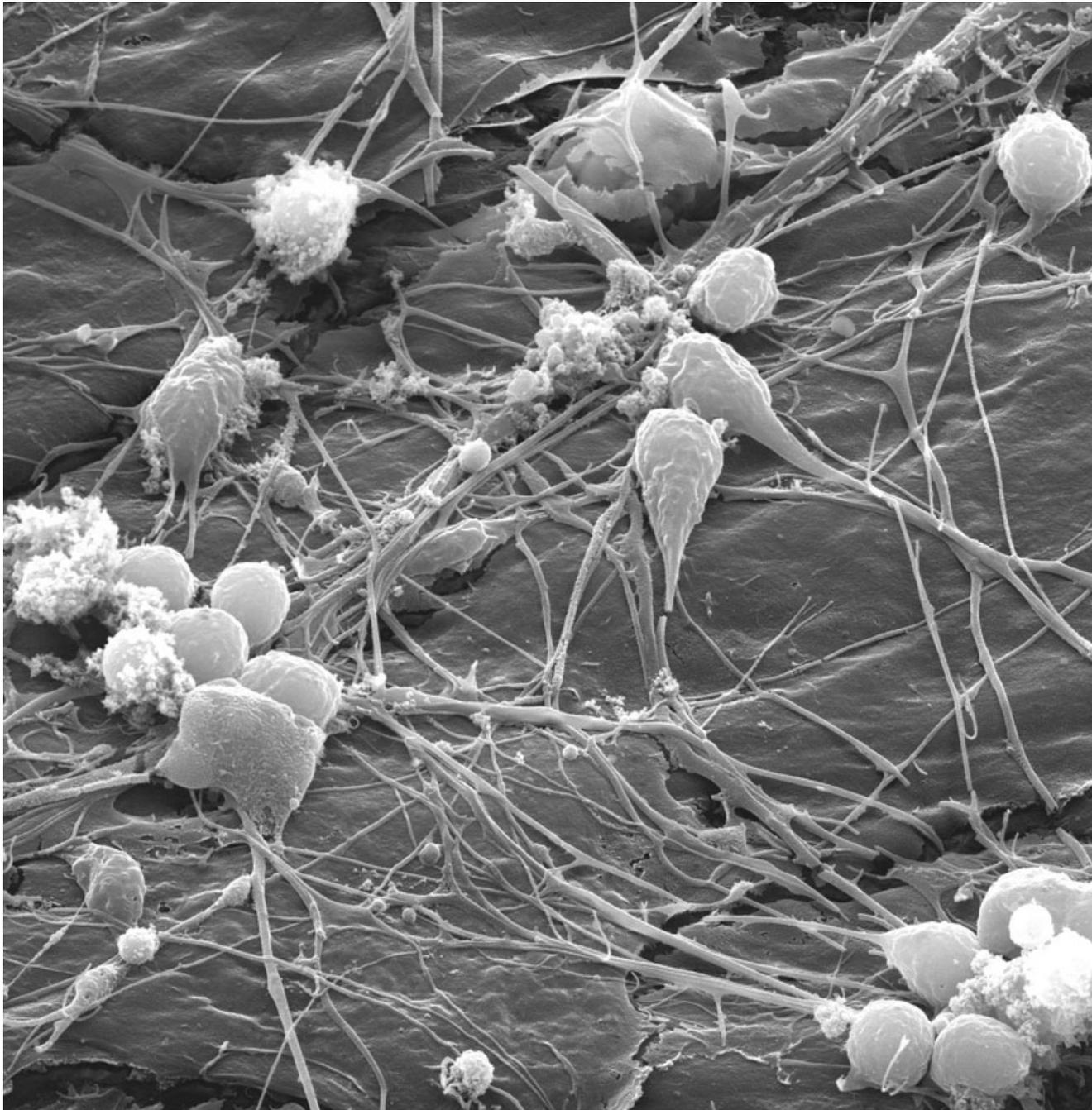


b

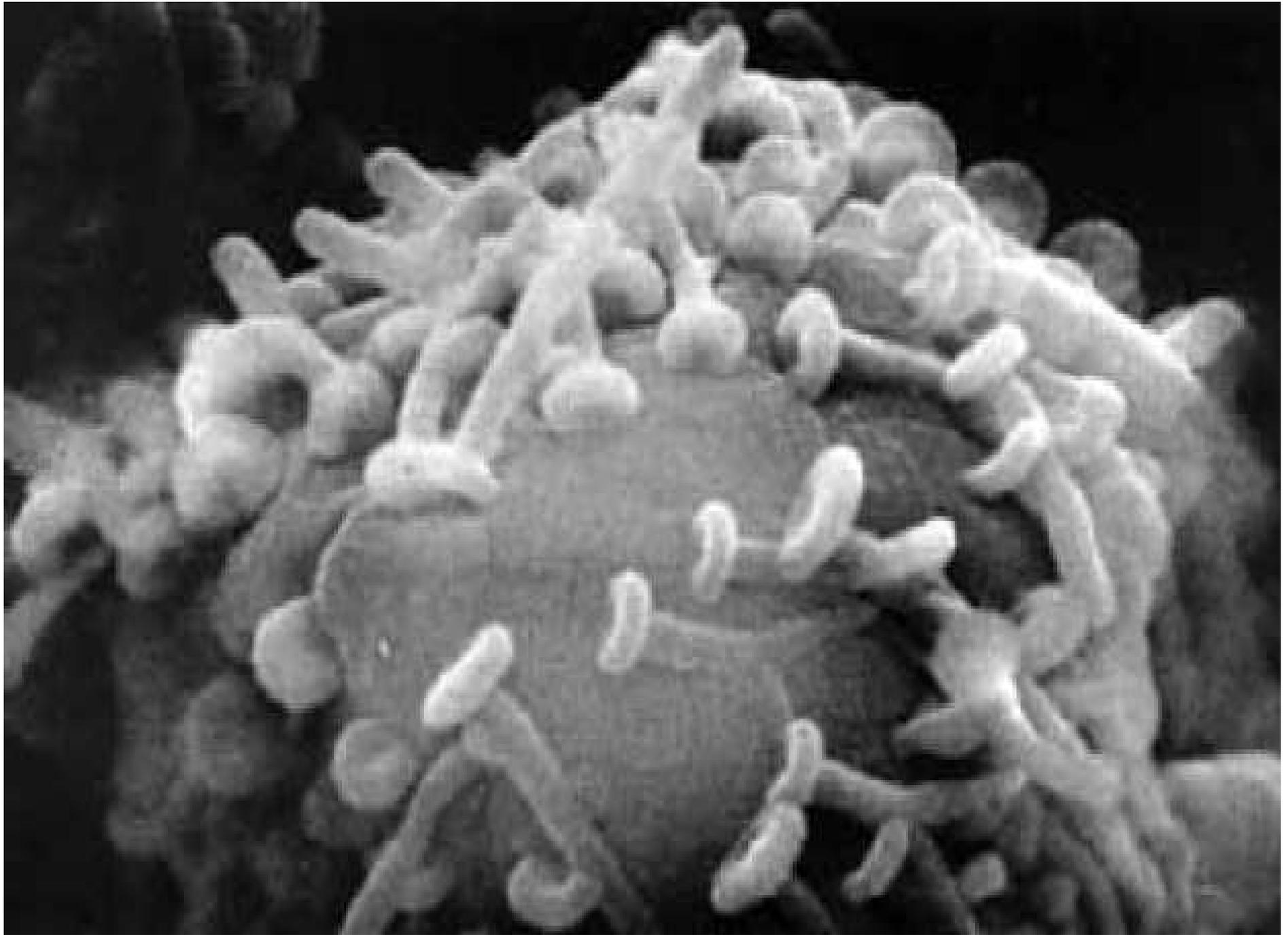
a) Aufbau einer Nervenzelle (stark schematisch) b) verschiedene Typen von Nervenzellen



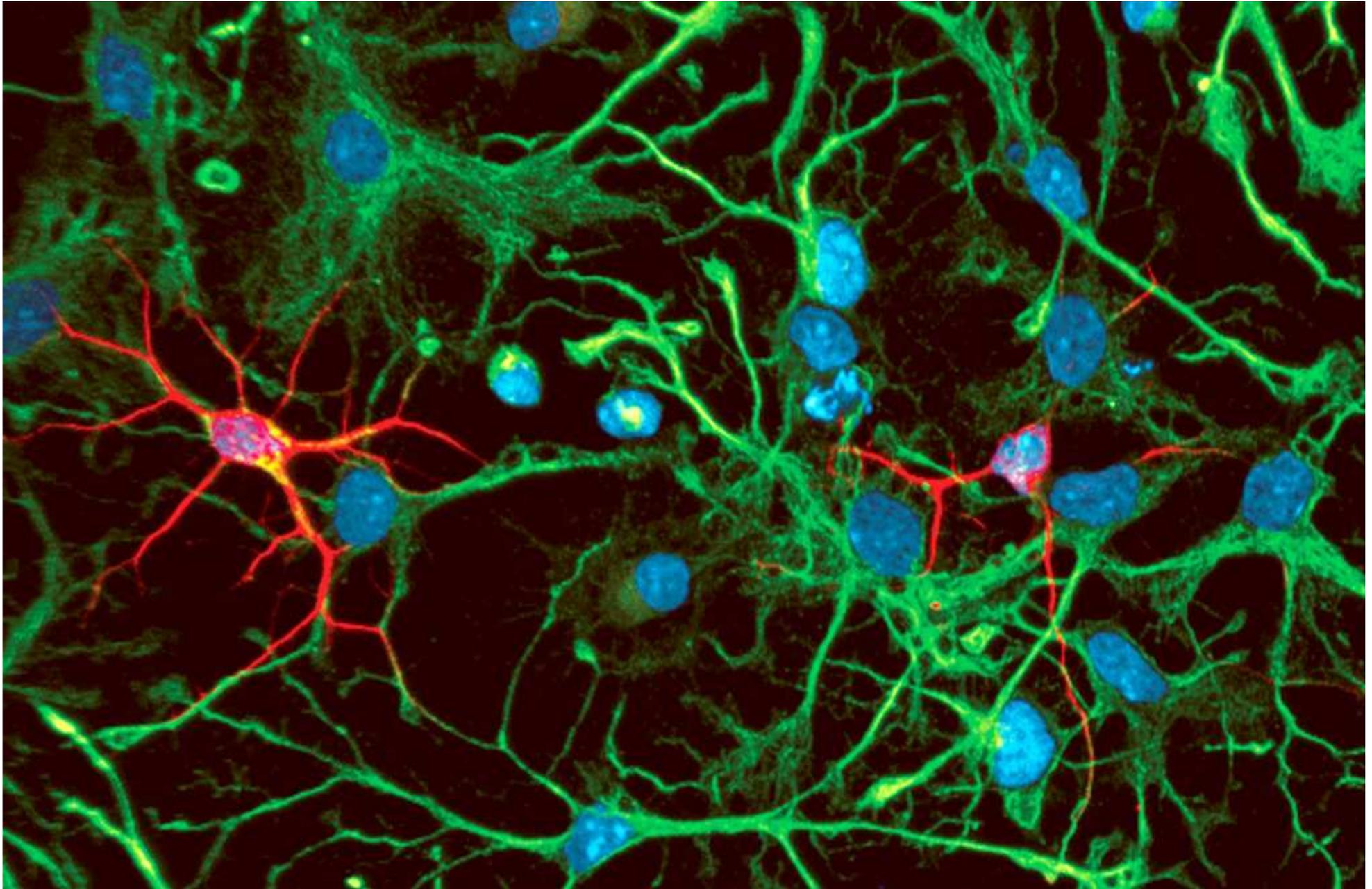
Feinstruktur einer Nervenzelle, Abbildung aus „Neuroscience, Exploring the Brain“



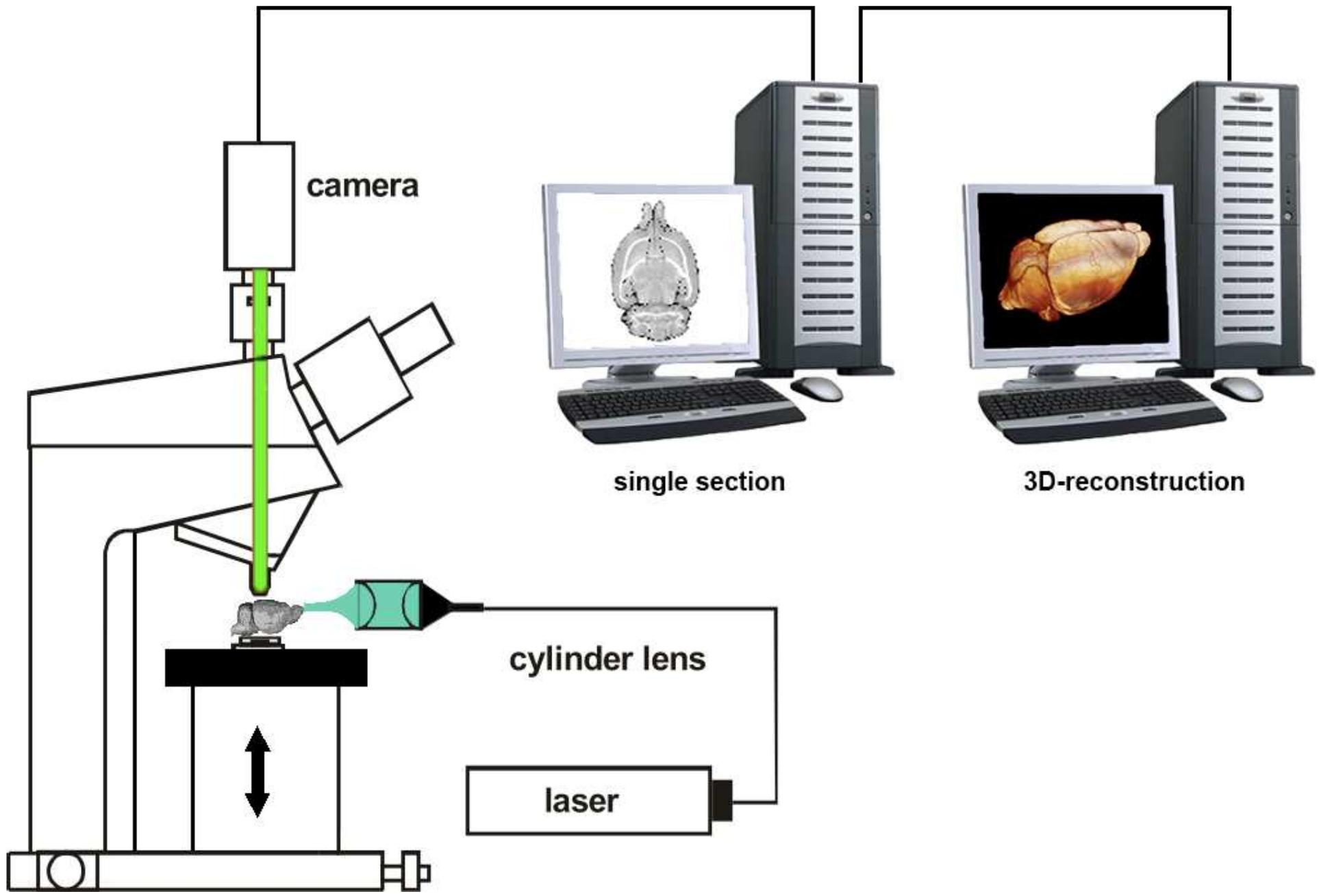
Elektronenmikroskopische Aufnahme kultivierter Nervenzellen. Copyright freie Abbildung aus dem Internet.“



Synapsen an einem Motorneuron. Copyright freie Abbildung aus dem Internet.“



Immunohistologische Färbung von Neuronen im Cortex. Copyright freie Abbildung aus dem Internet.“



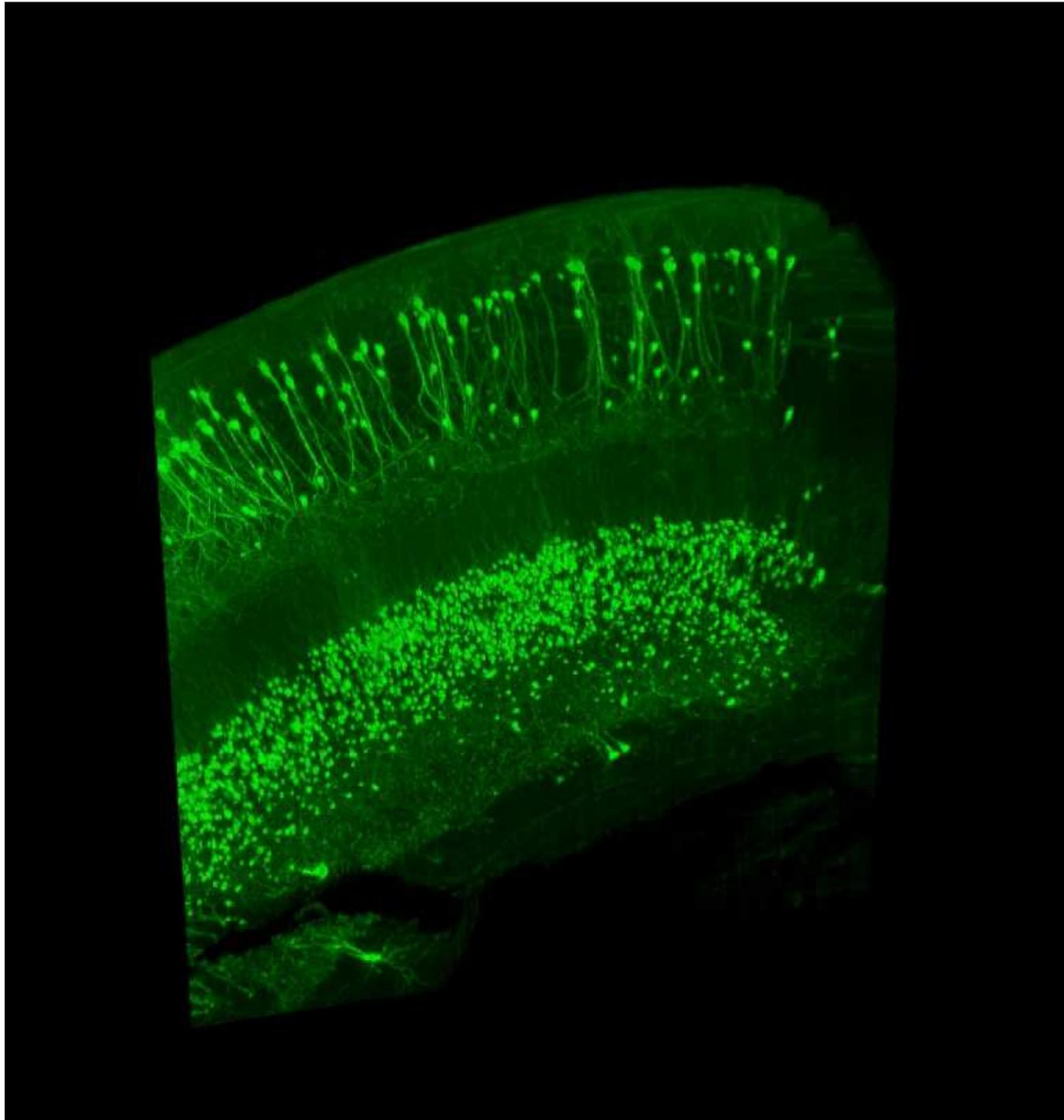
camera

single section

3D-reconstruction

cylinder lens

laser

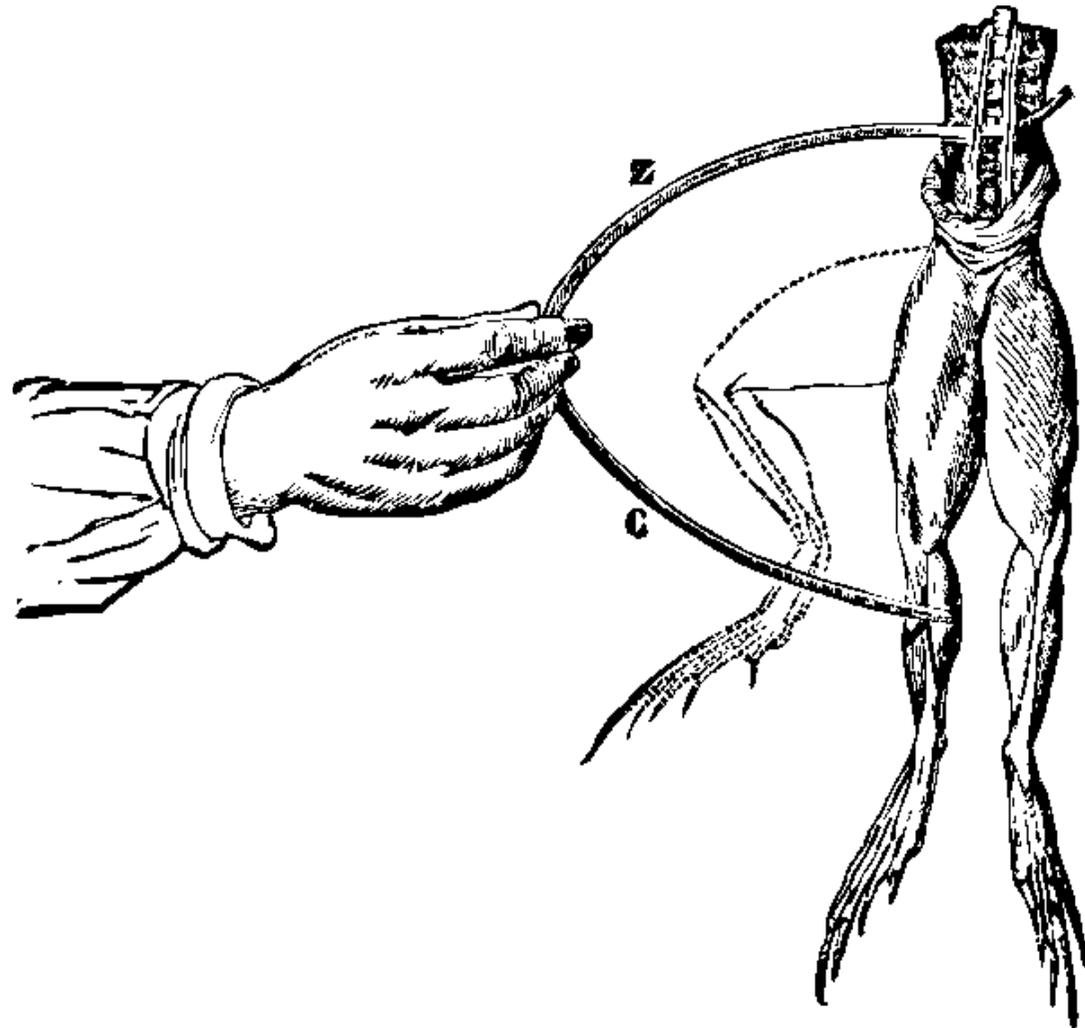


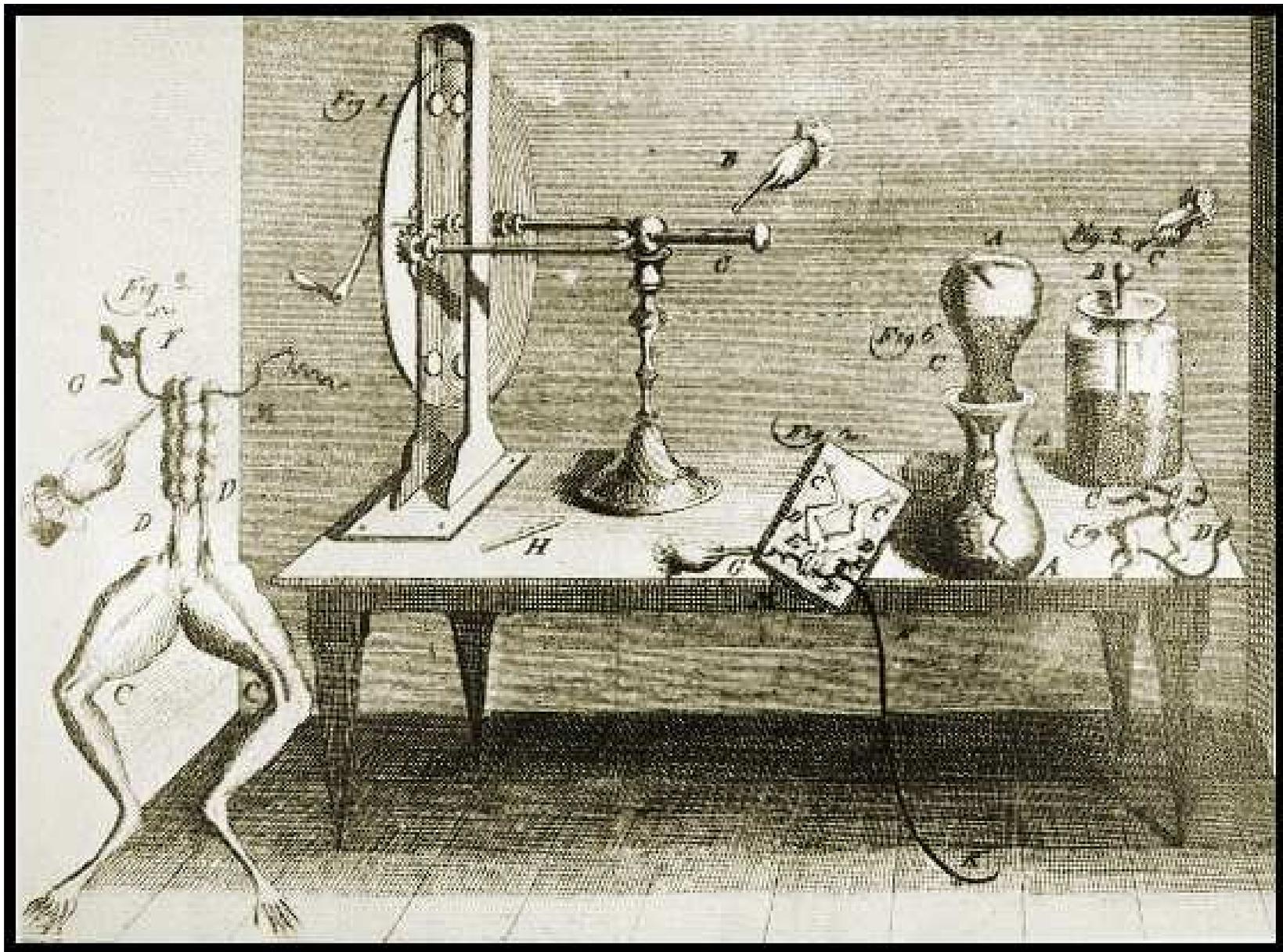
Ultramikroskopie, eigene Aufnahme

Neuronale Elektrizität



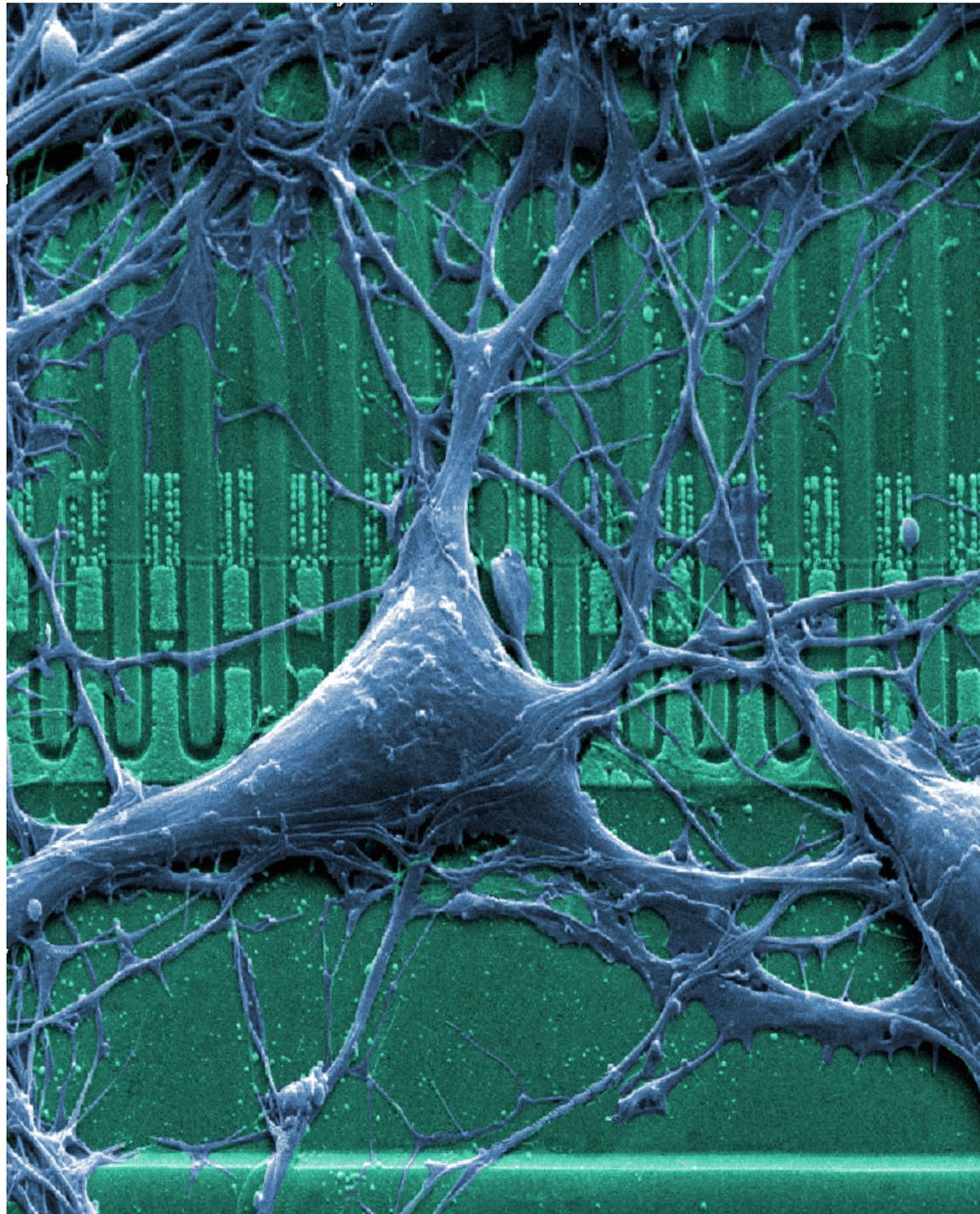
Luigi Galvani 1737 – 1789
Professor der Medizin in Bologna



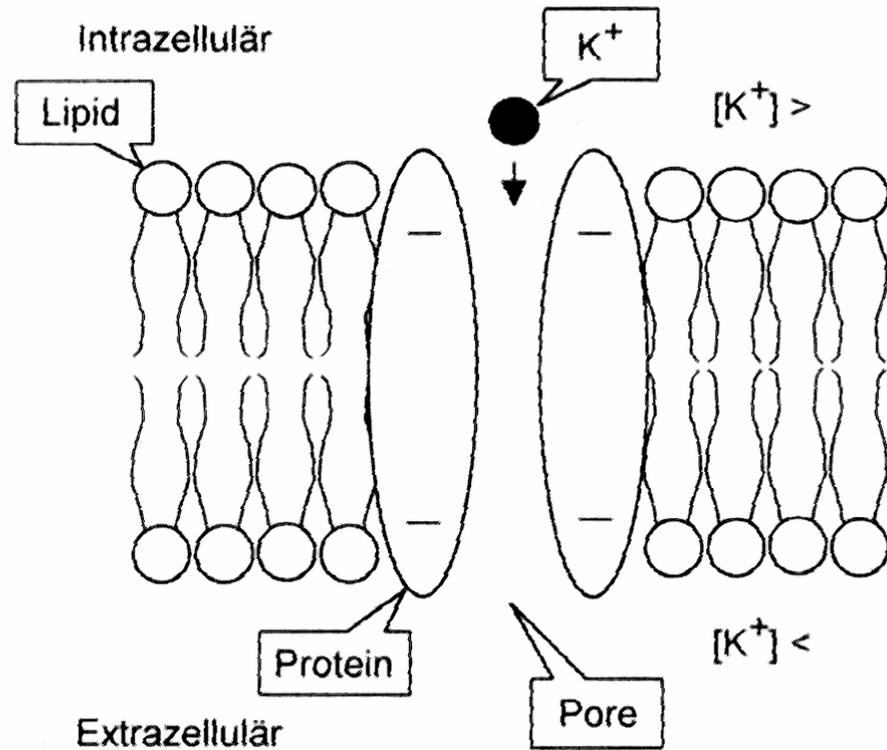
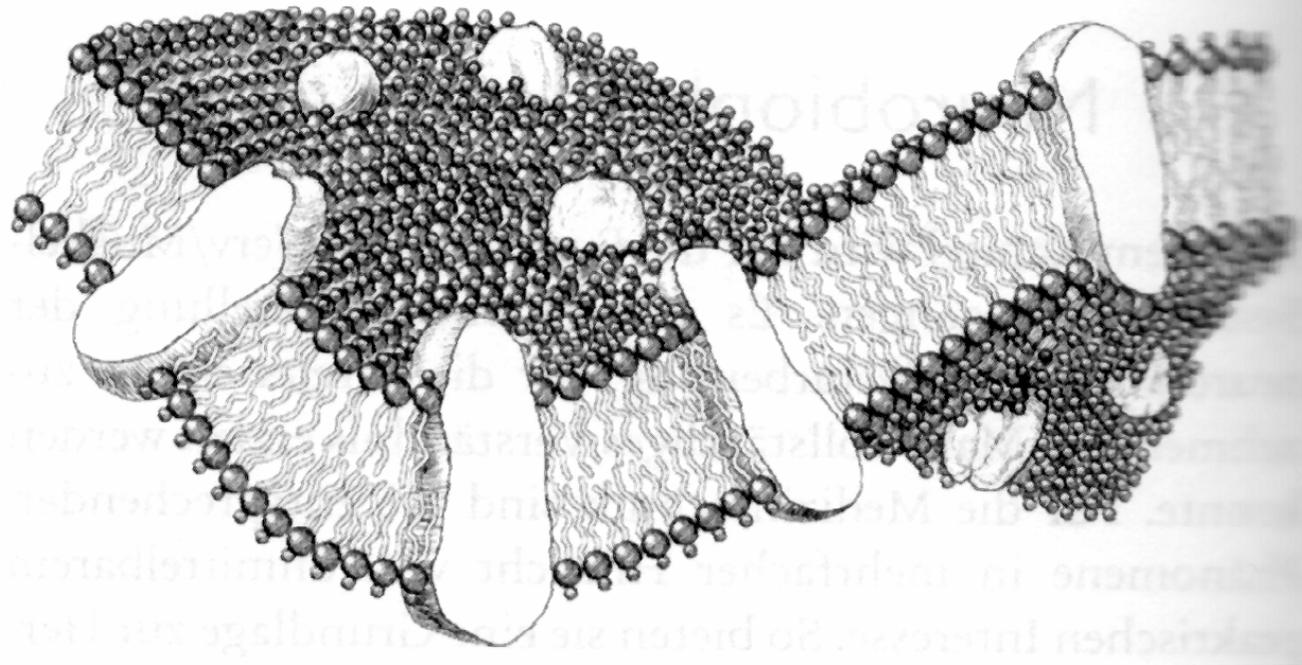


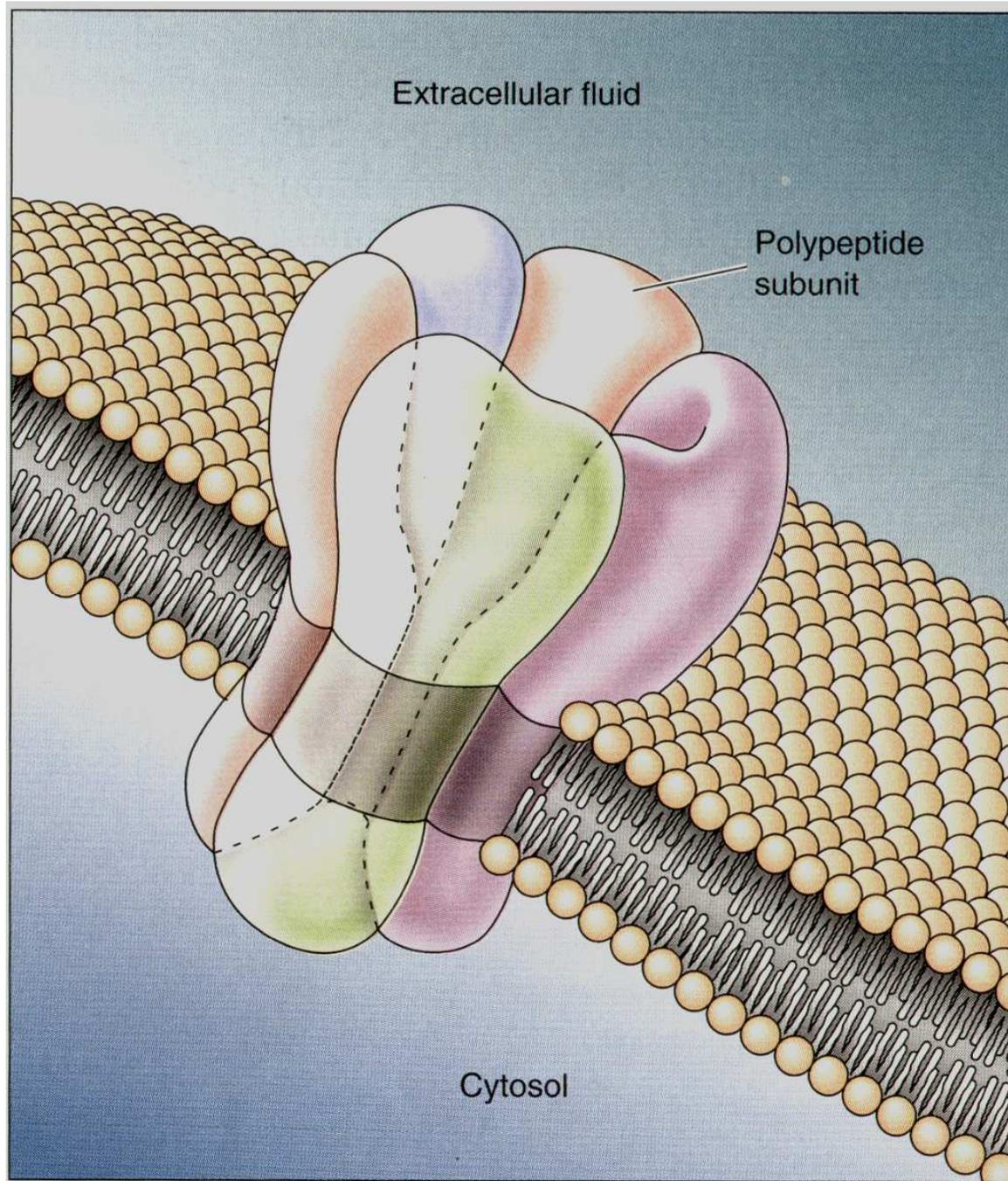


Mel Brooks Film „Frankenstein Junior“, 1972



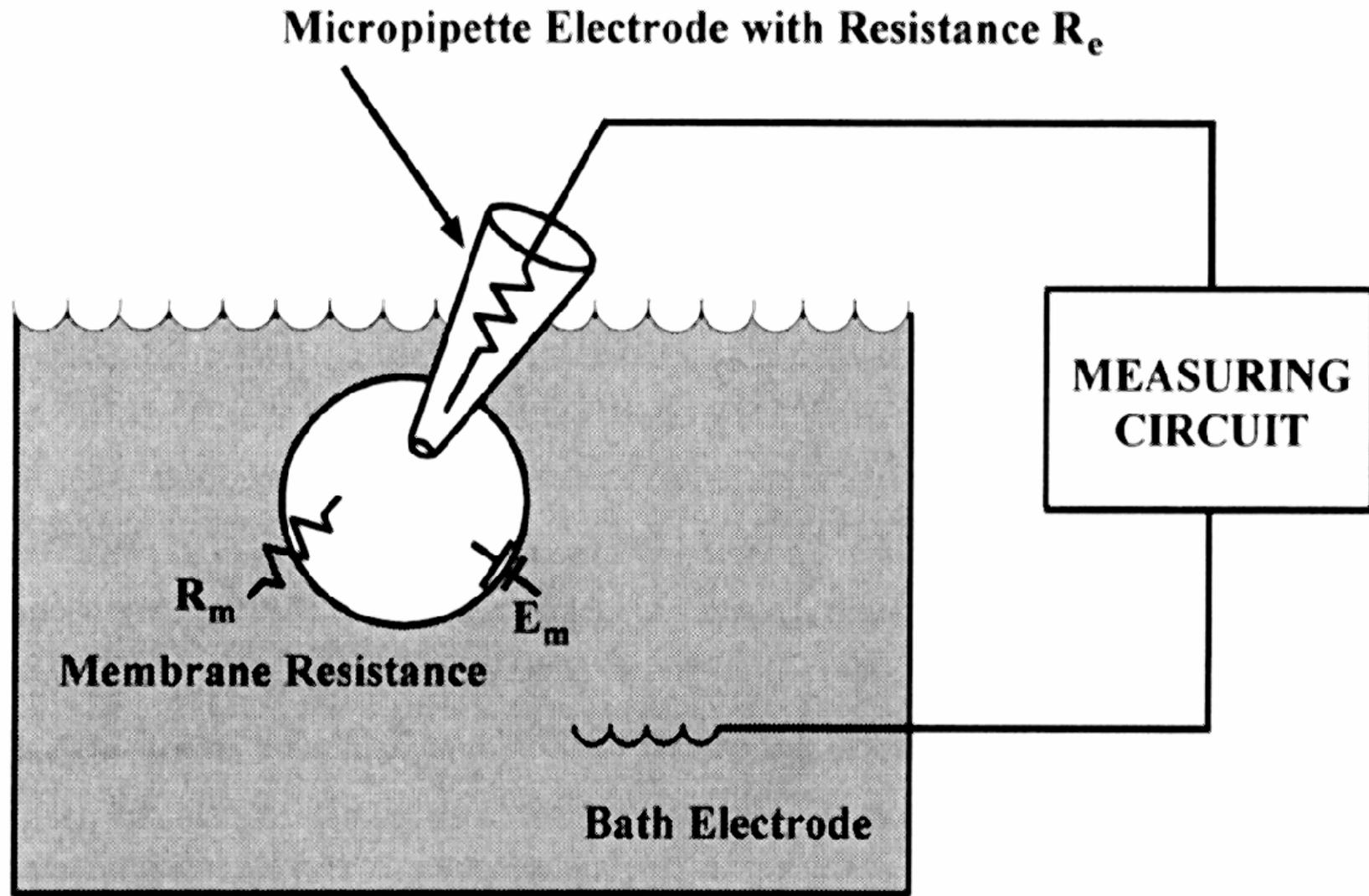
Rattenneuronen auf Biochip, copyright freie Abbildung aus dem Internet

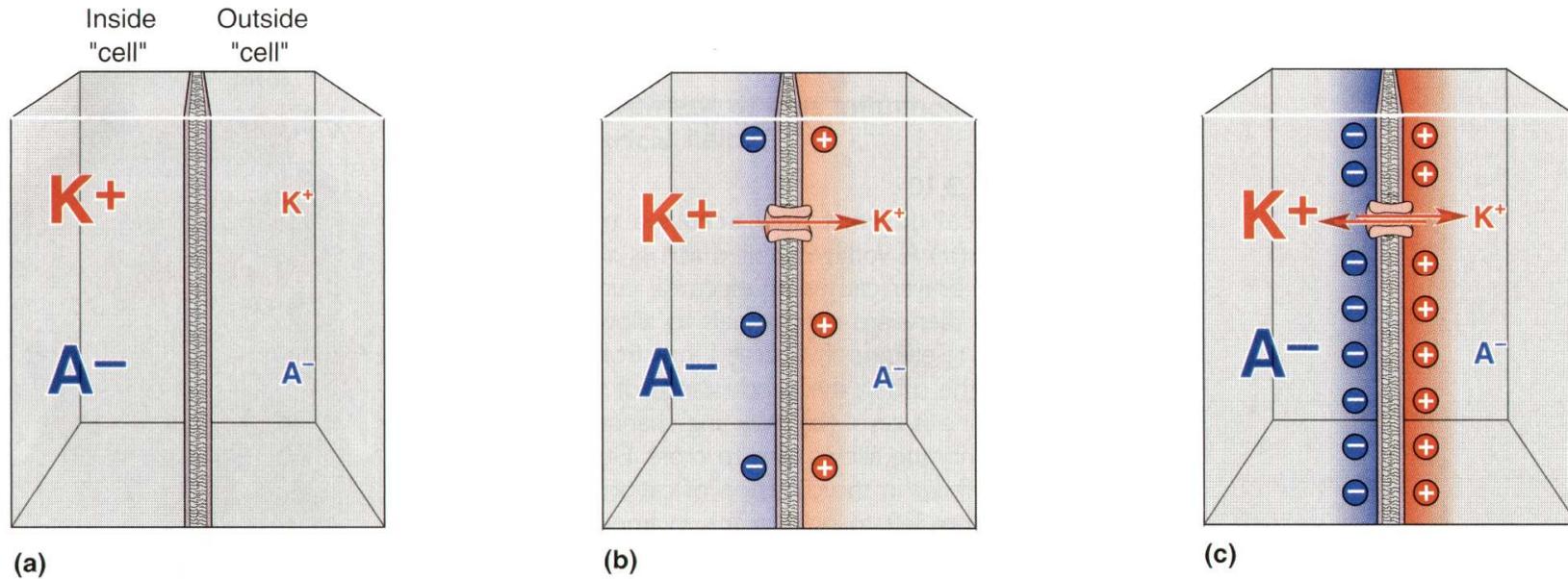




passive Membranpore, Abbildung aus „Neuroscience, Exploring the Brain“

A





| | extrazelluläre Konzentration | | | intrazelluläre Konzentration | | | Konzentr. Verhältnis | Diffus. richtung |
|---------------------|---------------------------------|-----|-----|---------------------------------|-----|-----|-------------------------|---------------------|
| | M | N | TA | M | N | TA | für M | |
| [Na ⁺] | 120 | 150 | 460 | 9 | 15 | 50 | 13 : 1 | ⇒ |
| [K ⁺] | 2,5 | 5,5 | 10 | 140 | 150 | 400 | 1 : 56 | ⇐ |
| [Cl ⁻] | 120 | 125 | 540 | 4 | 9 | 50 | 30 : 1 | ⇒ |
| [Ca ²⁺] | 1 | | | 0,001 | | | 1000 : 1 | ⇒ |

M: Muskel, N: Motoneuron, TA: Tintenfischaxon