# Theorem of the over-excited neurons in burnout

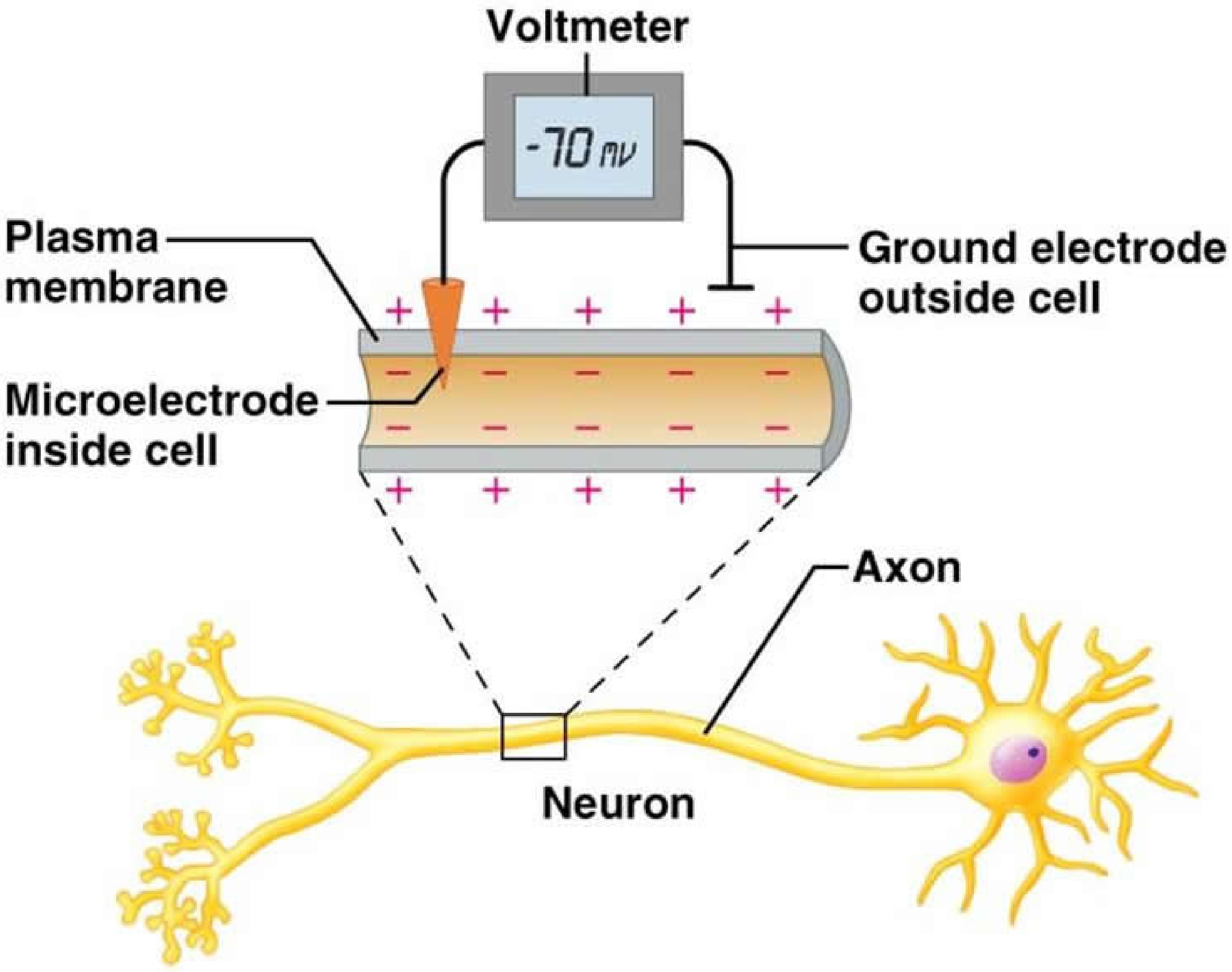
***Abstract.*** Burnout has been well defined by psychologists, and is a disease indeed of the last decades. Dr. Christina Maslach defined the concept, and the test 'Maslach Burnout Inventory'. This test is being used as the only authorative test on burnout in the world.

People, not knowing the theory, often express themselves as 'burned out', as if a lot of activities (like concentration) do not 'work' anymore and complain about somatic pains that MD's cannot physically observe. Recovery of burnout lasts 3 months on average. People who know burned out people agree that their working capacity at once dropped framatically, to only 5% – max. 30% of the working capacity before. This drop can come in a few days; the drop before the capacity loss usually has a build up time of at least 6 months. In the period before the sudden decrease in capacity, patients tyically show over-alertness- overactivity; they are are quickly 'nerved'.

In this theorem (Blankert 2013, whitepaper burnout.nl and burnout.be) a likely relationship is shown between the overall concept of burnout, and the concept over 'over excited neurons'.

### *'The overexcited neuron'*

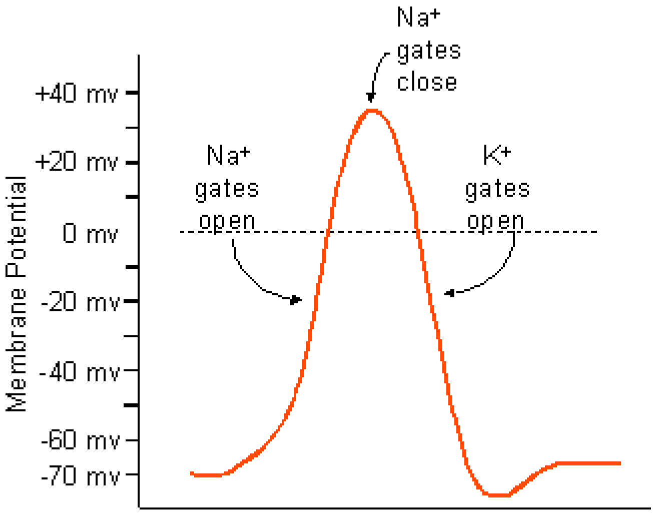
The concept of 'over excited neuron' is mentioned in several places in scholarly literature, but has never been properly defined of measured. To understand the concept, the following abstraction of a neuron is presented.




On the left you see two receptors; that is where new molecules can come, through making (almost) contact (='synapse') with the axon terminal of another neuron. A resting 'potential' is a neuron is typically -70 mV, and a typical ionisation consists of NA+CL- whereby the salt solutes, the CL- molecules go INSIDE the cell (through the cell membrane) and load the inner side of the neuron negatively. The Na+ atom remains on the outside; for matter of practicality, we set the outside not at a '+' but equal it to the 'ground', so zero.

The neuron gives an electrical signal (some neurons in both ways, in this case let us assume: one direction, from left to right) if the resting potential 'threatens' to be more than the 'typical resting potential' of -70 mV.

For example: on the left, at the two receptors, neurotransmitters are received, that PASS an 'ion gate' in the neuron's cell membrane. If an additional ions passes the cell membrane, it can suddenly increase the voltage or action potential of the neuron, making the voltage more positive than -70mV. In that case, a neuron has to get 'rid' of the excess voltage in the biomass, and starts to 'fire', meaning: an electric pulse 'fired' by the axon on the right. This amount of electricity 'fired' is measured in mAh, meaning: milli Ampere hours, mAh. Ampere hours will be familiar to you from all kinds of electrical devices at home.




After having fired, a neuron goes through a recovery period (refraction period).

Most people working in neuroscience have a physiological background, or pharmalogical background, and tend to give more attention to the chemical compound of neurotransmitters and other cells than electronics; it is however in the electronics most research progress can be made now.

Before 2000 it was certainly more difficult to measure voltage on a small scale, than it was to observe cells under a microscope. Implant of electrodes, or microelectrodes was necessary. It is generally not allowed to open the human skull if life is not threatened. On the other side, either, mankind has never succeeded in keeping brain cells alive OUTSIDE the brain.

So for electophysiological measurements, menkinid was limited to animals – as giant neurons of squids, or to cats and rats.

It has been observed that, if the recovery period of a neuron (the 'refractory period') is not respected, the neuron can fire a bit more, but becomes 'irregular' in its firing. The electricty pulses given by axons become more different than can be expected from the attaching and detaching of neurotransmitters and the receptor side, as well as through ions flowing in our out through potassium of natrium gates in the cell membrane.

The concept of 'overexcited neuron' is not well defined yet, but largely accepted by neuroscientists. The 'refractory period' (recovery period) however, has been study object since the seventies. Over excited neurons are often metabolized: they are seen as 'useless' and are broken down.

Since appr. 2006, the MEG, Magneto Ence Phalograpy, a scanner of subtal electric activity not even originally intended for medical uses, made its entrance in the medical world. It measures very weak neural activity in the brains, whereby patterns of 'louder signals' can be deducted from the 'overall noise pattern' in order to have the low signals. This is similar in how a shark can sense electronical signal that are (in Tesla) lower than earth' magnetic fields. The mathematics (including programming patterns) en electronics required to truelly understand the MEG, goes beyond requirements to a MD – and that is often a barrier to further research – also in burnout.

**Resemblance overexcited neuron and burnout**

The resemblance between an overall human's development towards burnout and a neuron towards 'overexcited neuron' and destruction/recovery becomes apparent, but requires research to be confirmed AND measured.

The human goes through the following phases:
1– sleep
2– normal activity
3– overactivity; stressed, agitated, irritated, overaroused
4- burnout

The neuron goes through the following phases:
1- sleep (! – a white paper about 'neurons in sleep' will appear April 2013)
2- resting
3- normal activity, including normal recovery / refraction period
4- overexcited neuron
5- either recovery of neuron (?extra long recovery period = repair period after 'knock out'? ; little research) or destruction of the neuron (metabolism) and replacement by a new cell (also here research is needed; is there similarity between maximum speed of neuron replacement and maximum speed of burnout recovery?)

Neurons are essential in humans functioning, because muscles are triggered by neurons, sensory impressions are transmitted by neurons but also 'thinking' is done by the ELECTRICITY of neurons. Electricity has the speed of light – no biological cell or molecule can have even a fraction of that speed, and that is why neural electricity is critical to our daily functioning. If in a certain neural circuit (/mechanism) significant clusters of neurons are 'over excited' or even 'knocked out' (=destructed, metabolized and having to be replaced), the human cannot function well in that area.

Neurons that are 'electronically worn out' and in a process of 'being replaced' cannot be seen by MD's, but CAN be observed by the MEG.

Therefore I propose a MEG study of burned out and vital people, to observe the difference of neural activity in the frontal cortex upon the presentation of different tasks.

The frontal cortex is the ideal area because:
- it is easily accessible for measurement
- 'thinking' and 'concentration' is typically where burned out people are impaired: even simple tasks as 'copy this pile of paper twice, and make three sets of documents' are too much to perform well for the burned out person. And this impairment is not relieved by one or more 'good nights sleep' or a 'fortnight rest'.

**Final question**

Who is in for the further research on the theorem of over-excited cells going along with burnout, and measurement of the frontal cortex neural activity with MEG?

J Philippe Blankert, M.Sc. M.A.
info@burnout.nl
Chairman of Stichting Burnout