WHEN FITS LOOM

Fabrice Bartolomei – Epilepsy is probably the oldest neurological malady described. It is found in Babylonian writings dating from three thousand years BCE. An epileptic fit is a momentary perturbation in the electrical rhythm of the brain and depending on how the various regions of the brain are involved, there can be extremely significant modifications to people's behaviour such as, for example, intense emotional modifications that can go as far as ecstasy. And ecstatic episodes are probably an example of phenomena that have changed the face of the world… For example Saint Paul on the road to Damascus who pretty much changes his religious point of view after what was probably an ecstatic epileptic episode. Another example that I have studied extensively is the feeling of déjà-vu. We have realised that when someone has a feeling of déjà-vu, there was a dialogue between the entorhinal cortex and the hippocampus that is the region of our brain needed for memory so that this memory circuit has been temporarily put back into play.

A big part of my research in the heart of INSERM is to see how all this is organised in the brain and how we can fight and interrupt this high degree of organisation that constitutes a fit. Indeed, an epileptic fit is not something anarchic, something that is so often thought to be a sort of firework display of electric rhythms in the brain. No, an epileptic fit is very, very organised, it is a modification to the rhythms in an area of the cerebrum, usually the cortex, that follows the paths that lead from the region where it started to other structures. And in spreading through the brain in an orderly manner that is very stereotyped, very repetitive, it gives rise to clinical symptoms. I often draw a parallel with the heart, that being a bioelectric organ that pumps and you have people with trouble in their cardiac rhythm. The brain is also a bioelectric organ that produces electrical rhythms but these serve to coordinate the cerebral regions with one another for a particular function. Now if you want to catch an object, the cerebral rhythms of the parietal lobe and the frontal lobe are going to synchronise with one another such that they will coordinate to give you this function. So it is an organ where there are rhythms and these rhythms, like in the heart, can become anormal. If it is for example in the motor region then you are going to have motor symptoms, if it is in the visual region, you are going to have a visual hallucination to start with and if it is in emotional regions like the temporal limbic system, you are going to have an emotion at the start of the fit. Often it is a deep fear or a feeling of growing anxiety, sometimes a feeling of déjà-vu, there is a whole range of phenomena linked to the change of these rhythms. There is a lot of research on the topic and when medicines do not work, on how one can try to stop these abnormal rhythms. That's why I take the heart as an example: you have pacemakers and you have systems that detect abnormal rhythms and

that stimulate the heart. In the brain, there are attempts nowadays to do the same thing, that is to say, to identify the zone that initiates the fit, detect it with a microprocessor then proceed to restimulate that zone. What we do is rather than to go and put a system on the brain that gives local stimulation, we apply external electrical stimulations on the head, little stimulations with currents that diffuse into the epileptic zone inside the head and to inhibit or diminish the electrical activity in this zone. That is why we call it transcranian electrical stimulation.

At Marseille we and the research team have developed a particular kind of stimulation: neurofeedback. The brain produces electrical activity that one can record, an electroencephalogram and one can analyse a part of this electro-encephalogram and make it appear on a screen then ask the patient to regulate the abnormal electrical activity that is detected. When a fit begins, well you lose conscience, you lose control, you lose a part of your neurological capacities, etc. So if you can reinforce this ability to control things, that gives people back their confidence. We ask the subject to, well, as you can imagine, you have a curve, you try to increase it for example. And here there is a whole process of learning unique to each subject, it might be a particular thought, in order to try to modulate this electrical activity in the brain. And we have found that with people who manage to do that, they bring this strategy to bear as fits begin, as they feel the start of a fit and, well, half the people manage to diminish the intensity of the fit and maybe even stop it.

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