

Epigenesis Shown by Abnormal Plasticity in Epileptogenesis of EL Mouse

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Received Date: Mar 30, 2019; **Accepted Date:** Apr 02, 2019; **Published Date:** Apr 06, 2019

Introduction

This brief manuscript intends to express the importance of the abnormal plasticity in the nervous system to demonstrate an example of bringing transformation in the animal world.

Abnormal plasticity observed in epileptogenesis of EL mouse

Epilepsy is known to be a highly complicated disease or syndrome [1]. An EL mouse is an excellent and established model of epilepsy. Several studies have elucidated the epileptogenesis of this disease using this animal model [2-5]. Epileptic seizures in the EL mouse are provoked by natural proprioceptive sensory stimulation, including repeatedly tossing the animal into the air [4,5] or by performing rotating (see saw) movements [6], but are not induced by loud sounds or vestibular stimulation. In addition, the EL seizure still occurred even after the labyrinths were destroyed, at that time the animal could not maintain its posture. Therefore, the seizure-provoking mechanism in the EL mouse occurs through the proprioceptive nervous system by abrupt accelerating movements [5].

The seizure susceptibility of EL mouse is seemingly autosomal dominant in genetics [7,8]. However this susceptibility of EL mouse is successively increased by the naturally sensory stimulation to the animals [5]. If repetition of this stimulation procedure is interrupted, the seizure susceptibility decreases gradually within several days. But when the procedure reopens, the susceptibility to the seizure increases, namely seizures are more easily observed comparing with a case of a naive animal.

This process of developing unfavorable results against the animal, i.e. obtaining seizure susceptibility in this case, is named as an abnormal plasticity [5]. This abnormal plasticity observed in EL seizure can be represented by not only a phenomenon of a seizure but by electrophysiological and biochemical, in other words, cellular and more precisely genetic aspects reported previously [3,5]. It might be thought as one of epigenetic phenomena.

The process of learning or memory in the animal world

On the other hand the Long-Term Potentiation (LTP), which was discovered by Lloyd [9] or Bliss et al. [10] at first, is considered to be the cellular correlate of learning and memory until recently. The LTP-induced plasticity is believed to confer beneficial effects to an organism. Not only these effects but various neuronal mechanisms themselves should bring an organism to develop or gain further. In other words, these effects might be thought to contribute to progress of an organism and to be one of the beneficial processes for the survival of the fittest.

Transformation or revolution of organisms (animals and plants)

Here one might discuss the topic "beneficial plasticity and unfavorable abnormal plasticity in the case of the animal world.

On the process of development of an organism usually one can mention development, adaptation or positive transformation at the law of the survival of the fittest followed after Darwin's Doctrine. In the nervous system one can mention many examples of the basic mechanism, e.g. the discoveries by Lloyd [9] or Bliss et al. [10].

On the other hand one can think a disuse or atrophic process, as a negative transformation in many species.

Here one may mention another kind of phenomena in transformation. The phenomenon was demonstrated in Aplysia sensory neurons, the induction of long-term reflex sensitization but in turn facilitation of defasciculation and sprouting of neurites and new synapse formation by Kandel and his school [11]. In our paradigm of abnormal plasticity observed in EL seizure, the stimulations to the proprioceptive neuronal system elucidate new activities of a seizure provoking mechanism. These bursting neuronal activities themselves lead to DNA fragmentation or disarrangement of some constituents. These phenomena might be considered to be one of the epigenetic phenomena in referring to Thomson's review e.g. [12].

Conclusion

One can consider the process of revolution or transformation of organisms (animals) as following.

- Development due to the growth, plasticity in a favorable domain.
- Extinction due to loss of vitality.
- Aberrant transformation due to abnormal plasticity or other unfavorable mechanisms.
- This point of view might open another new way of thinking on the living organisms.

Ethics

The author have read and abided by the statement of the ethical standards for research involving laboratory animals described by the US NIH Office of Laboratory Animal Welfare. All animal care and procedures were conducted in accordance with the IACUC (No.21-18, 2002) of our institution, which is officially approved by the Japanese Society of Experimental Animals, an internationally approved society. An important member of the committee is a veterinarian. In addition, all possible efforts were taken to avoid animal suffering and to minimize the number of animals used in the experiment. Additionally, the author referred to the standards for the publication of mouse mutant studies written by Crusio et al. [13] for all experiments conducted.

Conflicts of interest

This research was carried out under the authority and funding of Sannou Institute of Psychiatry and Psychology and Tokyo Institute of Psychiatry.

The authors have no conflicts of interest to disclose. Financial support was supplied by both institutes, and the author belonged to both institutes during the study period and the period of preparation of the current report.

The author confirms having read the Journal's position on issues regarding ethical publication and affirm that this report is consistent with those guidelines.

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