

**The concept of "Developing the Brain"**  
**-A natural science for learning and education-**

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Education has been a critical issue for human societies since the Greek age of Socrates, Plato and Aristotle, and even earlier. Good education with an emphasis on a healthy mind and body is the foundation of strong nations, and thus essential for national security and prosperity. Conventionally, the discipline of education has been looked upon as one of the humanities. Many important books on education have been written by Plato, Kant, Rousseau, Steiner, Langevin and others.

The most general meaning of the word education is the bringing up of children physically and mentally. Its original meaning, however, is from the Latin word of *educatus* (e-duc-tus), which refers to the directional guidance of learning. Education and learning are closely related concepts, but differ in that education deals with externally provided concepts while learning is based more on those that are internally generated. That is, a learner is a subject developing independently, but can also be an object to be guided through education. This essential distinction can be seen not only through the humanities, but also through natural science.

I will discuss certain broadly expanded concepts of learning and education from the viewpoint of natural science, and will propose the possibility of a new type study on learning and education.

From a biological viewpoint, learning and education are closely related to brain development because the brain is an adaptable information processor open to the environment. Stimuli from the environment cause new neuronal connections to form which allow better adaptation to the environment. Learning is the process by which the brain reacts to stimuli by making neuronal connections that act as an information processing circuit and provide information storage much like a database. Therefore, a biological viewpoint is essential in the study of learning and education, although this has not been a major concern in the established discipline of education. Also, from a biological viewpoint, education is a process that should guide and inspire the construction of the basic architecture of brain information processing by preparing and controlling the input stimuli to the brain.

The components and the basic architecture of the brain are made by using the information contained in genes. However, there is a great deal of room left for an epigenetic process free from gene control, and stimuli from the environment strongly affect substantial parts of the brain. In other words, the brain system is genetically prepared with a large potential for various functions, and a suitable environment can stimulate healthy brain development and proper application of brain functions. Education is a process of optimal adaptation that guides

the learning that ensures proper brain development and functionality.

This comprehensive new field “Developing the Brain”, also requires higher levels of trans-disciplinarity than is now common. Many disciplines must work together to develop this new field through close collaboration that transcends the borders of the different disciplines by bridging and fusing.

I believe that the science of learning and education could become one of the most important fields in the 21<sup>st</sup> Century.

## References

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