



Swiss Society for Neuroscience (SSN)

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Editorial

First of all, the SSN council wishes you a very pleasant and scientifically exciting new year 2006. In spite of the inevitable loss of a few society members each year (mainly due to retirement or change of activities), our society is still growing, as indicated by a regular increase of memberships. Although the SSN counts at present about 750 members, there is no doubt that the community of neuroscientists in Switzerland is much larger than this figure. We therefore need to make an effort in recruiting colleagues who are active in the field but not yet members of the Society. As a member of the SSN, you can certainly help the Council in this task by encouraging your collaborators to join the SSN. A special invitation will be transmitted by the council to all colleagues who are not yet members, but who registered to the SSN annual meeting that will take place in Basel on January 28th, 2006. If you plan to attend the meeting in Basel and have not yet registered as participant, do so on-line on the SSN website.

In 2007, the SSN annual meeting is already planned to take place in Bern, following the usual one day format that has been used for about 10 years (except for the meeting in Zurich in 2005 which was organized in collaboration with the USGEB). In the year 2008, the SSN annual meeting will not take place, due to the FENS 2008 meeting that the SSN has the responsibility of organizing in Geneva. Although the format of our annual meeting was largely successful in the past, the pause in 2008 may be an opportunity to make a brain storming on the format of SSN annual meetings in the future, starting in 2009. The SSN council will very soon initiate a re-evaluation of the principles guiding the organization of the SSN annual meetings. In order to do so, the SSN council will need your feed-back and, therefore, you will be invited to respond to a short enquiry on how you perceived the previous meetings. Of course, we will at the same time favor your suggestions for improvements and propositions for new or other activities during these meetings. Many thanks in advance for your active collaboration in this re-thinking of the SSN annual meetings.

Eric M. Rouiller

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SSN-IBRO Fellowship for young investigator 2006

After some hesitation, the Swiss National Science Foundation finally decided to pursue in 2006 its financial support to offer a fellowship for a foreign post-doc to join a Swiss laboratory (basic and/or clinical research) in the field of neuroscience.

The deadline for submitting applications to the SSN-IBRO Fellowship 2006 is January 15th, 2006 (see guidelines on the SSN website).

SSN travel fellowships 2006

On the occasion of its meeting at the beginning of January, the SSN council will make a final decision on the number of travel fellowships offered to attend the main two events of the year, namely the FENS Forum 2006 in Vienna and the SfN meeting in Atlanta. The SSN already informed the FENS that at least 12 travel fellowships of Frs 700.-- will be offered to attend the Vienna meeting. Depending on the finances, this number may be increased in order to provide a clear signal that the SSN strongly supports the European neuroscience meeting that takes place every two years. Final information on the number of travel fellowships, deadline for application will be given on the SSN website as of Monday January 16th, 2006. Remember that the deadline to submit an abstract to the FENS Forum 2006 is January 31st, 2006.

SSN meeting 2006 in Basel

The SSN annual meeting in 2006 will take place in Basel, on January 28th, in collaboration with the "Swiss Society of Neuro-Radiology". For the first time, abstracts were submitted "on-line" (about 200 abstracts were received in time). Although some improvement can be made in the procedure, the submission of abstracts was generally smooth, making much easier the collection of abstracts by the local organizing committee. In addition, all submitted abstracts were accessible on-line for the SSN members, immediately after the deadline. Furthermore, abstracts can be sorted according to categories, authors, etc, in order to prepare your visit to the poster session (see menu "Abstracts" on the SSN website). The SSN council is presently working on the selection of the 10 abstracts for the "Data Blitz" oral presentation (3 minutes each). The authors invited to present their work during the "Data Blitz" will be informed by e-mail on Friday

January 13th, 2006. The SSN council looks forward to seeing you in Basel.

Brain Awareness Week in 2006

Funding available for Brain Awareness Week 2006 (March 13-19, 2006) – Call for applications

FENS offers financial support to organize an event during the Brain Awareness Week. The Brain Awareness Week is a worldwide celebration of the brain that grows more successful every year. It is an opportunity to let people know what is being done to diagnose, treat and prevent disorders of the brain, such as Alzheimer's, Parkinson's, stroke, schizophrenia and depression.

For many years, the Dana Alliance for the Brain has offered financial support to those who organized a brain event during the Brain Awareness Week. In 2006, for the first time, the Dana Alliance for the Brain (<http://www.dana.org>) has asked FENS to administer this support reserved for European organizations contributing to the Brain Awareness week.

FENS therefore invites applications for this support. Please use the ad-hoc application form to submit your application and return it to the FENS Office Berlin by e-Mail (gibson@mdc-berlin.de) referring "Brain Awareness Week".

The deadline for application is January 31, 2006.

The SSN council strongly encourages the SSN members to be active and organize local activities in this context. Remember, it is also our mission to inform the public on the research progress in Neuroscience.

Eric M. Rouiller

Meeting announcement

"BeNeFri" block course for Ph.D students
in Neuroscience:

Brain, Behavior and Plasticity

Open to all Ph.D students

Fribourg, February 15-17, 2006

Final program available from January 16th on the web site:

<http://pylwww.unibe.ch/benefri/>

Brain Development in the early school years

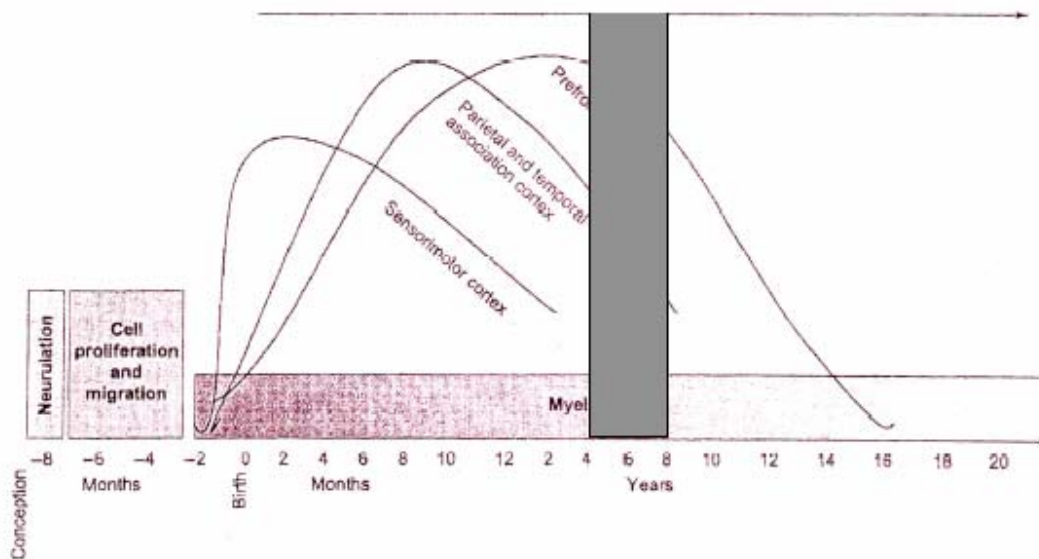
Professor Norbert Herschkowitz

Several Swiss cantons are currently experimenting with a new school curriculum that combines two years of kindergarten and the first two years of primary school into a "Basisstufe," or "Grundstufe". The age of the pupils ranges from 4 to eight years, and the pupils are instructed in age-mixed classes with two teachers. Reasons for this new concept include the support of a continuous transition from playful learning to systematic learning and greater consideration of a child's individual learning path.

The length of time spent in the Basisstufe depends on the individual development of the child. The program introduces a flexible age for the entrance into the Basisstufe and a flexible age for entrance into the third grade of primary school. At the end of the third primary school year cognitive, psychological and social skills will be compared with those of over a thousand pupils who will have experienced the classical division between kindergarten and primary school.

Knowledge gained from research in developmental neuroscience can provide valuable insights that can help parents and educators establish a learning environment that takes greater consideration of the needs of the individual child and the specific interaction of genetics and experience that drive the child's brain development. I will mention selected aspects of brain development that are relevant for the years 4 to 8, which correspond to the years encompassed by the new "Basisstufe".

Synaptic pruning



Human brain development: Synaptogenesis and synaptic pruning. Adapted from B.J. Casey, N. Tottenham, C. Liston, and S. Durston. *Trends in Cognitive Science* (2005) 9: 104-110. Shaded column refers to age of children in "Basisstufe."

The first 4 years are characterized by an overproduction of synapses, a period referred to as "blooming." The period of blooming (increase of synaptic density) is followed by a period of synaptic pruning (a decrease in synaptic density), which is characterized by the elimination of unused synapses and the consolidation of frequently used synapses, a process essential for learning.

Pruning begins at around the fourth postnatal month in regions subserving primary functions such as motor and sensory systems. This is followed at around 8 to 10 months by a decrease in synapses in the temporal and parietal association cortices, which are associated with basic language skills and spatial attention. In prefrontal and lateral temporal cortices, which integrate sensorimotor processes, modulate attention, language processes and integrate executive processes, pruning takes place from 4 years to about 20 years. This means that from four years on, pruning takes place concurrently in the sensorimotor cortex, the associative parieto-temporal cortex, and in the integrating prefrontal cortex.

Neurotransmitters

Changes in the rate of synthesis of neurotransmitters and in the nature of their respective receptors play a major role in learning and memory. Receptor densities for glutamate and GABA in the prefrontal cortex reach a maximum within the first decade, facilitating a balance of excitatory and inhibitory functions and leading to an enhancement of learning and memory.

Dopamine is involved in reward processes and in motivation. The anticipation of a desired goal is accompanied by the release of dopamine. The projection of dopaminergic fibers to the nucleus accumbens and the frontal cortex most likely contributes to this motivational state. Dopamine-1 receptors attain peak density in the putamen and caudate nucleus between 3 and 8 years. Maximal activity of the dopamine transporter molecule is reached between 9 and 16 years. These facts may partly explain why children do not set long-range goals or implement behaviors to attain them until they are 6 to 7 years old.

Although the rate of serotonin synthesis peaks in many sites at 3 years, serotonin receptors do not reach maximal density in the basal ganglia, hippocampus and cerebellum until 5 to 6 years. Serotonin exercises a pacemaker function in establishing patterns of activity. By modulating the effects on neuronal excitability in widely diverse brain regions and the spinal cord, the serotonin system can coordinate complex motor and sensory patterns of behavior. Children under 6 years are more impulsive than older children. The latter find it easier to suppress inappropriate behavior. The increased serotonergic activity could contribute to the more reflective behavioral style.

Acetylcholine plays a central role in learning and memory. Thus it may be of importance that at around 4 years Acetylcholinesterase-positive pyramidal neurons, believed to be restricted to humans and apes, first appear in the association layer 3 of the motor and associational cortices.

Connectivity: Myelination

The years 4 to 8 are a period of fine tuning of cortical connections, accomplished by the elimination of superfluous synapses and the strengthening relevant connections.

Axons reaching from the cortex to the brainstem and spinal cord myelinate rapidly between 3 and 6 years. The posterior corpus callosum, linking temporal and parietal sites in both hemispheres, myelinates later, from 6 to 15 years. Long tracts linking non-contiguous cortical sites within each hemisphere show a spurt of myelination after the third year.

The recent development of diffusion tensor imaging in MRI, which provides information on the directionality and regularity of myelinated axons is an additional tool for examining the role of cortical connectivity in cognitive development.

Connectivity: EEG Coherence

The coherence of EEG frequency bands is defined as the degree to which assemblies of cooperatively interacting neurons in various brain regions show synchronized activity, an indication of transient neuronal connectivity. Between 3 and 6 years, the magnitude of coherence between frontal sites and temporal, parietal and occipital areas increases significantly. The neurons that participate in the encoding of features converge and "bind" related features by means of transient synchronization over multiple frequency bands. The shaping of these connection relies on experience-dependent processes. It is of importance that the postnatal growth spurt in coherence does not take place in children with Down Syndrome.

Developmental processes taking place between 3 and 8 years result in a massively interconnected neural network, establishing the integration of cortical and subcortical structures. This facilitates the increasingly complex processing of increasingly complex information as the child responds to and acts upon objects and events in his/her environment.

Language Areas

Between 3 and 5 years the predominant blood flow in the parieto-temporal cortex, involved in processing visuo-spatial and auditory information, shifts from the right to the left hemisphere. It may not be a coincidence that this shift is accompanied by the ascendance of language abilities, such as the formation of semantic categories.

The connections between the Wernicke and Broca Areas show a spurt of myelination around three years. Between 4 and 6 years dendritic growth is rapid in the left Broca area. However, after 6 years there is more abundant growth of dendrites in the right Broca area, possibly contributing to the emotional and prosodic components of language. The comprehension and expression of irony, sarcasm and humor are enhanced after the sixth birthday.

The acquisition of a second language, whether acquired simultaneously with the native language, or learned later in life, makes a difference in the activation of the Broca area. When the second language is learned between the age of 3 and 7 years, the same sites are activated in the Broca area. However, when the second language is learned after the age of seven years, the activity pattern extends the Broca sites. The evidence suggests that the age when a second language is learned affects the organization of the Broca area and may help to explain why it is easier to learn a second language in childhood than later in life. However, it is still possible to learn a second language even at an advanced age.

Prefrontal cortex

One of the most significant events of brain development in the first 8 years is the increasing connectivity within the prefrontal cortex and between it and other cortical and subcortical structures. The integrative functions of the prefrontal cortex, which participates in working memory, planning of actions, control of inappropriate actions and consciousness of feelings, are inferred from the dense and wide set of anatomical connections. The mediodorsal nucleus of the thalamus is a prominent source of afferents to the prefrontal cortex. It projects to the orbital and medial prefrontal cortex (limbic), the dorsolateral prefrontal cortex (cognitive), and to the anterior cingulate cortex, which integrates motivation and emotion with cognition and motor drive. The mediodorsal nucleus of the thalamus is further connected to cortical sites that mediate somatic, auditory, visual, olfactory, and gustatory information, thereby facilitating multimodal associations.

The evolutionary expansion of the prefrontal cortex in humans means that it comprises about one third of the total cortical surface, compared to one tenth in the non-human primate. This enhancement was made possible by mutations or recombinations of genes that permitted progenitor cells in the embryo's brain to divide for about 72 hours longer than they do in chimpanzees, leading to the production of 100 billion neurons, compared to the 10 billion in apes.

A salient change that takes place in the human prefrontal cortex between 2 and 8 years is the appearance of dendritic trees covered with short spines resembling adult morphology on layer-3 macropyrarnidal neurons. The number of spines per dendrite is greater in the prefrontal cortex than in other cortical sites. This increases synaptic efficiency to a remarkable degree. Experience is likely to have an important modulating effect on this development.

Concluding remarks

Neuroscience can contribute relevant knowledge to questions faced by educators. One problem in the area of learning is the delineation and differentiation of ongoing brain development and experience-driven processes. Another central issue is the question of whether school instruction can alter neural networks related to cognition in ways that generalize knowledge beyond the specific domains of instruction. However, neuroscience cannot prescribe curriculum guidelines and teaching methods. This task involves the interdisciplinary efforts in the fields of Education, Psychology, Sociology, and Neuroscience.

Professor Norbert Herschkowitz, Bern, December 2005

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