



July's edition of the newsletter provided insight into different cognitive styles, intuitive vs analytical and how understanding our intuition is key to skilled thinking. This month, we explore brain development to show how ageing can affect cognitive ability.

## THINKING SKILLS PROGRAMME: THE FINAL PHASE?

This summer marked the end of the first phase of the Defence Thinking Skills Programme. There are proposals for a further phase to disseminate as widely as possible the products of the first phase. If this goes ahead this will take place over the next year. So far the programme has developed a range of activities and resources, and we have been trying them out with different audiences. We now understand that the most powerful way to make Defence 'smart' is to attune our everyday language and behaviour to make the most of the way our brains think. So our focus has been on whittling down the science to a few powerful facts, and then finding different ways of embedding them into Defence culture. For example, mini-rituals to highlight unrecognised assumptions, or re-framing questions to highlight biases. We believe that once these ideas start to be socialised across different areas of Defence, the people using them will adapt them to suit their own circumstances better. We have on offer some papers and lectures, pictures and words, games and apps, good practice and principles, tools and techniques. Over the next year, we hope that we will be helping many of you to become advocates for a thinking skills culture, and providing you with support to make Defence an elite thinking organisation.

## HOW OUR BRAINS DEVELOP:

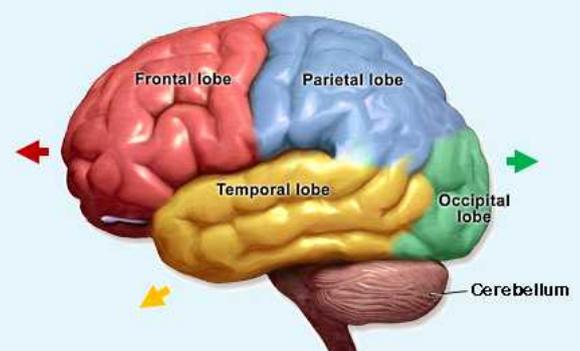
There are many different and complex processes involved in every stage of our brain development that makes us who we are. Both the brain and central nervous system (CNS) are important in cognition. The CNS can be subdivided into peripheral (nerves that consist outside the brain and spinal cord) and autonomic nervous system (the non-conscious part of our nervous system). The autonomic nervous system can be further divided into the parasympathetic nervous system

(responsible for 'Rest and Digest' responses) and the sympathetic nervous system (responsible for 'Fight or Flight' responses).

## EARLY DEVELOPMENT

During gestation, our developing brain can be divided into 3 parts: the forebrain, midbrain and hindbrain<sup>1</sup>. These sections will develop into many different important structures in our brain. For example, the forebrain will form structures like the cerebral hemispheres (involved in processing language, sensory and motor information).

The growth of our cerebral hemispheres is specific to the region of the brain. Different areas of our cerebral hemispheres are divided into lobes. The frontal lobe grows forward, occipital lobe backwards and the temporal lobe downwards and forwards. This gives the overall effect of the brain looking a bit like a boxing glove, with most of the temporal lobe forming the 'thumb'.



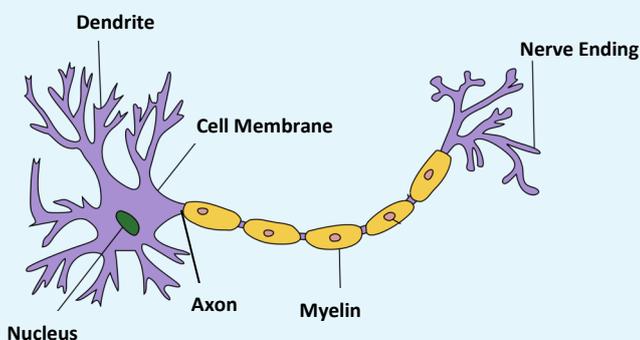
A. Cerebral Hemisphere growth. The different colour arrows show how each corresponding lobe grows during development.

The midbrain will form upper brainstem structures which are associated with processes like: vision, hearing, sleep/wake cycles, and temperature regulation. The hindbrain will form the lower brainstem (which contains heart and lung control centres important for modulating breathing) and the cerebellum (coordinates and refines motor activity).

## POSTNATAL DEVELOPMENT

After birth, our brain is only 25% adult size; brain enlargement will mainly occur due to insulation

around areas of our brain cells, in which time the brain will increase in weight by 1Kg (the average weight of the adult brain is 1.3Kg). This process increases the speed of communication between areas of our brain and affects learning, IQ and cognition. Differences in the amount of insulation in different areas of our brain have an effect on normal cognitive development, working memory and musical ability<sup>2</sup>. 90% of the brain develops before we are 5 years old. However, our brains aren't 'set in stone'; they are plastic, connections in the brain change depending on our experiences. For example, if you study and learn about a topic, connections in the brain are made to remember the information. Once you stop using this information the strength of the connection will reduce and the ability to recall that information will decline.



**B.** Neurones communicate with each other via axons (insulated by myelin) and dendrites

## AGEING

As we get older our brain starts to shrink<sup>3</sup>, disrupting communication in our brain between neurones and other areas of the CNS as connections are lost. Altogether these changes in our brain mean that as we age our reflexes are slower and the speed at which we walk and talk reduces. Our short term memory can also be impaired, which is essential for learning new things. So what can we do to reduce the effects that ageing has on our brains?

Diet and exercise can help, but most importantly staying mentally active by continually creating new connections through new experiences and then renewing them by using them. Apply Thinking Skills to everyday life to enhance your cognitive ability and learning. Learn a new skill, try different thinking styles, play memory games and brain teasers to keep active. So why not give the monthly teaser at the end of this newsletter ago!

## REFERENCES

<sup>1</sup>Sadler, T.W. (2005) Embryology of Neural Tube Development. *American Journal of Medical Genetics*. **135**:2-8

<sup>2</sup>Fields, R.D. (2008) White matter in learning, cognition and psychiatric disorders. *Trends Neurosci*. **31**:7 361–370.

<sup>3</sup>Klemm, W.R. (2012) What happens to the ageing brain. *Psychology Today*. [www.psychologytoday.com](http://www.psychologytoday.com)

<sup>4</sup>Blausen gallery 2014. *Wikiversity Journal of Medicine*. Available at: [https://commons.wikimedia.org/wiki/File:Blausen\\_0111\\_BrainLobes.png](https://commons.wikimedia.org/wiki/File:Blausen_0111_BrainLobes.png)

<sup>5</sup>Anatomy and Physiology. *US National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) Program*. Available at: <https://commons.wikimedia.org/wiki/File:Neuron.svg>

## TEASER SECTION:

### ANSWER TO JULY'S TEASER

Which is the word in English that has nine letters, and remains a word at each step even when you remove one letter from it, right up to a single letter remaining. List each letter as you remove them, along with the resulting word at each step?

Startling -> Starting -> Staring -> String -> Sting -> Sing -> Sin -> In -> I

### THIS MONTH'S TEASER

If Neil and Diane grow leeks,  
Alec and Lisa grow carrots  
and Jacob and Chloe grow beans.

Do Tom and Andrea grow courgettes or marrows?

**Find the solution in next month's edition.**

## GOOD LINKS TO LOOK AT:

For more brainteasers and brain training to keep active why not visit: <http://www.lumosity.com/>

Want to find out more about the Thinking Skills Programme and previous newsletters visit: <https://vle.cds.cranfield.ac.uk/>

A new repository, Think! Evidence, is now available with access to literature of interest to Thinking skills. To take a look visit: <https://evidence.thinkportal.org/>

### CONTACT US:

If you've enjoyed reading this and wish to be added to the mailing list or have any general feedback, please feel free to contact us ([dfac-tsp-admin@defenceacademy.mod.uk](mailto:dfac-tsp-admin@defenceacademy.mod.uk))

*This is Lucy Skelt's (from Cardiff University) first newsletter since Aaron Vick's return to Plymouth University. Please feel free to send feedback and any general comments if you wish to: [LSkelt.cu@da.mod.uk](mailto:LSkelt.cu@da.mod.uk)*