4. What is *muscle memory a*nd how does it apply to singers?

This term can be misleading as it tends to imply that muscles themselves have a memory, which is not possible. The term is used to describe *a complex pattern of muscle activity or activities that is created through repeated practice.*

This pattern of activity can then be reproduced without conscious thought, either on command or at a particular stimulus. In other words, the muscle or muscles have been trained to behave in a certain way. This behaviour will be reproduced in exactly the same way each time that task or movement is required. A better term for this complex pattern of muscle activity is **motor memory.**

A motor memory is created not by muscles, but by the brain. The muscles are only responsible for the movement, while the brain coordinates all the muscles involved in the task and creates and stores the memory.

During repeated practice, the part of the brain known as the cerebellum is responsible for the refinement of movement and muscle coordination. Structures deep within the forebrain (the basal ganglia or striatum) are also involved. The memory of this complex pattern is formed and stored in the supplementary and pre motor cortical areas of the brain.

In everyday life we are all familiar with creating motor memory, such as reaching for a cup and bringing it to the mouth without spilling the contents. We learned this coordination as a toddler and such an action takes a lot of repetition before the bib is no longer required! If however, the ability to control the muscles from the brain is disrupted, as in stroke, then a new pattern will have to be established through repetition and embedded afresh in the brain of the patient.

Establishing motor memories in singers is much more complex as it is necessary to coordinate postural, respiratory, vocal tract articulatory and laryngeal muscles simultaneously, as well as many others. When we bring the voice to performance, we then have to add physical movement – gesture, unusual body postures, and particularly in musical theatre, the complex demands of singing and dancing simultaneously.

Contrary to the belief of some practitioners, motor memories in singers cannot be created by focusing on single muscles or even muscle groups. In singing, the whole body is involved in the creation of these motor patterns. This is why the use of kinaesthetic motor imagery, activated through *Embodima* ™ gesture, as presented in this series of articles is such a powerful and effective training method.

We have to be very careful in establishing motor memories because if they are laid down incorrectly, poor technical skills and ultimately poor motor execution will become ingrained. Once fixed, these patterns will take a lot of expert technical work with the student to eradicate them, and then restore good practice. This is one reason why establishing good technique at the outset – particularly with young beginners – is so essential, and why, above all, these students should be taught by competent, trained vocal coaches and not non-specialist – or generalist - music teachers.

*Embodima gestures

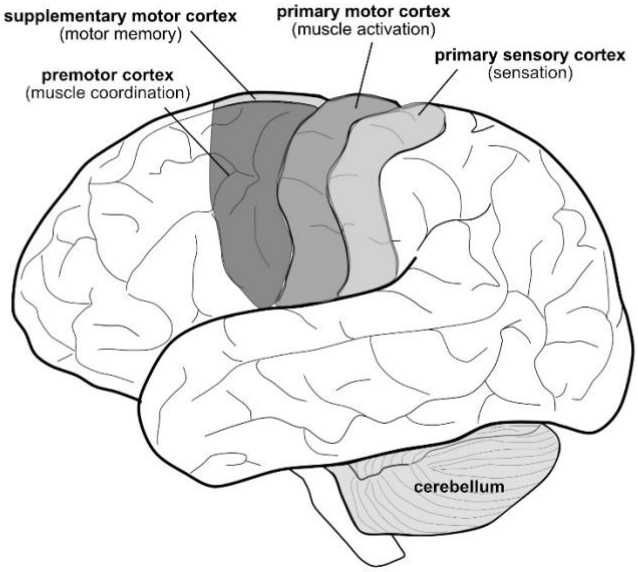

Figure showing the regions of the brain discussed

1 Doyon J, Bellec P, Amsel R, Penhune V, Monchi O, Carrier J, Lehericy S, Benali H. 2009. Contributions of the basal ganglia and functionally related brain structures to motor learning. Behav Brain Res 199(1):61-75.

2 Yaguez L, Nagel D, Hoffman H, Canavan AG, Wist E, Homberg V. 1998. A mental route to motor learning: improving trajectorial kinematics through imagery training. Behav Brain Res 90(1):95-106.