
MANCHESTER
1824
The University of Manchester
BIOL21332 Motor Systems

Motor Control is Organised Hierarchically

The motor control systems work so well because of two features of their functional organisation

1. Motor control is hierarchical and distributed between the spinal cord, brain stem and forebrain.

2. Sensory information is processed dynamically and in parallel systems to motor information allowing it to influence the evolution of a movement.

Motor Control Hierarchy

1. **Spinal cord** is at the bottom of the hierarchy.

   It contains circuits that control both reflexes and rhythmic movements such as walking and swimming.

2. The **brain stem** is the next level the hierarchy.

The brain stem contains two descending pathways that project to the spinal cord.

The *medial descending systems* of the brain stem deal primarily with core muscles of the body and are involved in posture control

The *lateral descending systems* of the brain stem deal primarily with distal muscles and are involved in voluntary goal directed movements.

Motor Control Hierarchy

3. The **cortex** is the highest level of the motor control hierarchy.

   The primary motor cortex and multiple premotor areas regulate activity in the brain stem descending tracts as well as projecting directly to the spinal cord.

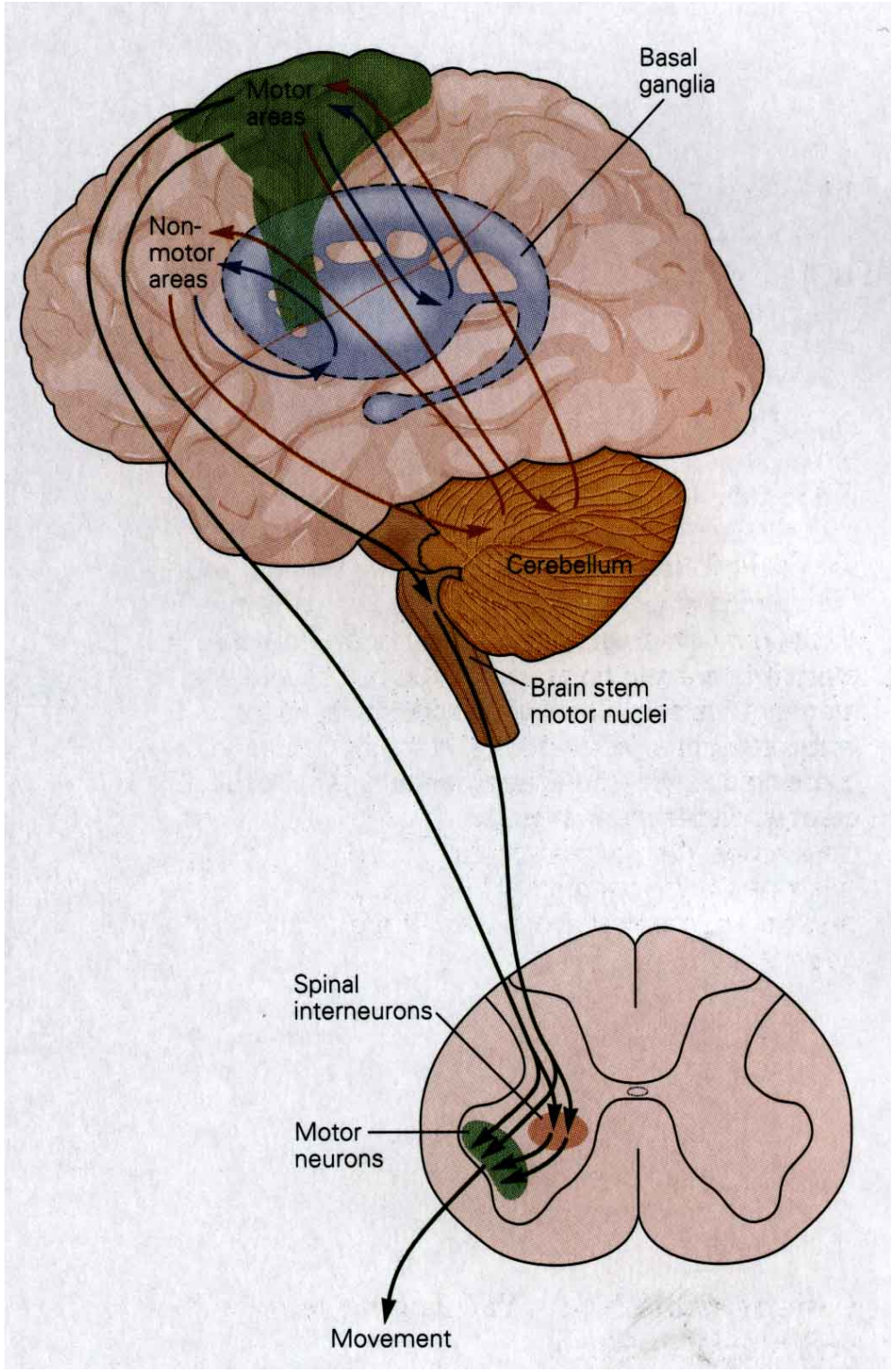
4. The **Cerebellum** and **Basal Ganglia** also play a role in regulating, planning and coordinating various muscles during voluntary movements.

Motor Hierarchy

Spinal motor neurons execute movement

Lateral and medial descending pathways, from the brain stem, influence the activity of circuits in the spinal cord.

The cerebral cortex controls the action of motor neurons in the brain stem and spinal cord.



Motor Hierarchy

Both cortical and subcortical inputs affect activation of the motor cortex.

Cortical areas that project to the motor cortex include prefrontal, parietal and temporal association areas.

The basal ganglia and cerebellum regulate activation of the motor cortex via the thalamus.