

The image is a composite. The top left features the University of Manchester logo, which consists of the word 'MANCHESTER' in white serif font and '1824' in yellow serif font, both on a purple rectangular background. Below the logo, the text 'The University of Manchester' is written in a white serif font. The background of the entire slide is a photograph of a university campus. It shows a wide, paved path curving through a green lawn. There are many mature trees with green foliage. In the background, there are modern university buildings with large windows and a traditional stone building with a tower. The sun is shining from the top right, creating a bright glow and long shadows.

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.

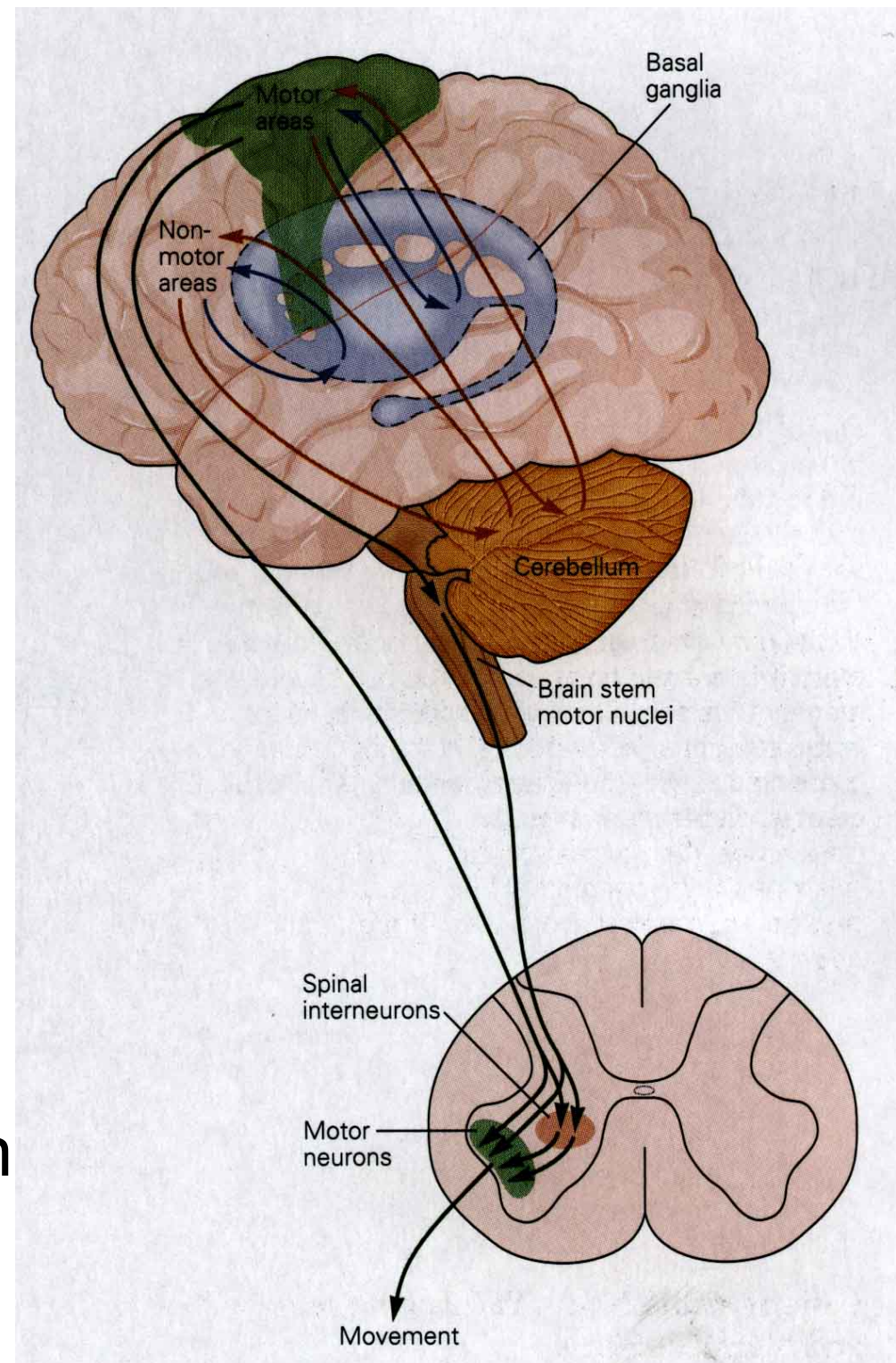
4. The **Cerebellum** and **Basal Ganglia** also play a role in regulating, planning and coordinating various muscles during voluntary movements.

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.

