

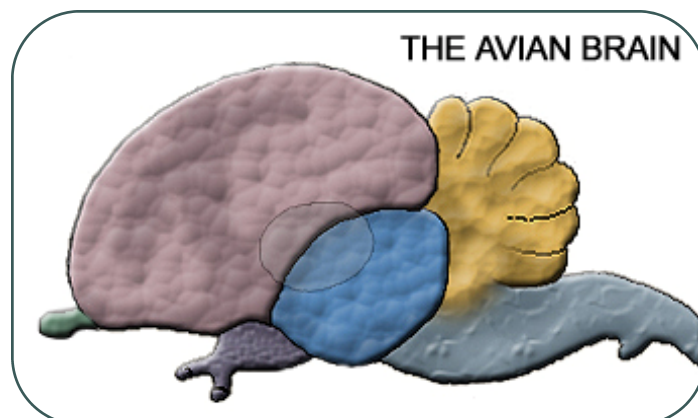
## Nervous System and Special Senses

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The term “bird brain” has often been used as an insult to indicate that a person is not very clever. This implies of course that birds are stupid and have limited brain capacity. This is far from the truth, as the bird’s brain is highly adapted for those functions critical for survival. As far as we know, most birds don’t sit around worrying about problems or planning ways of making money or getting out of doing homework. The portion of their brain that would do these tasks, the cerebral cortex, is not well developed. However, those portions of the brain essential for survival such as sight, hearing, fast and highly coordinated movement, recognition of danger, courtship and reproduction, establishing and defending territory etc. are all highly developed.

The nervous system is made up of two parts, the central nervous system, which includes the brain and the spinal cord, and the peripheral nervous system that includes the nerves and ganglia.

The main function of the brain is to integrate the information received from the special senses and peripheral nerves, process this information, store it as memory and coordinate outgoing messages to other organs in the body such as muscles and tendons. All organs and tissues of the body are linked to the brain by a complex network of peripheral nerves. The anatomy of a bird’s brain and the main functions of each part are shown below:



A schematic of a bird brain

*Yellow: cerebellum, responsible for coordination and balance;  
Grey: medulla joins the brain to the spinal cord and controls breathing;  
Blue: optic lobes that integrate sight; Dark grey: optic tract that brings impulses from the eye ball to the optic lobe;*

*Purple: cerebral cortex for “higher learning”;  
Central circle: thalamus that controls sleep, body temperature, water balance and many other functions;  
Green: olfactory lobe that coordinates the ability to smell.*



Birds also have an autonomic nervous system that automatically controls the reflexes and important body functions such as breathing and heart rate. The sympathetic part of the autonomic nervous system sends out impulses that speed up heart rate, constrict blood vessels and slow digestive tract activity. The parasympathetic system based in the brain, has the opposite effect.

## Diseases of the Nervous System

There are many important diseases that affect the nervous system. Notably, two of the most important Foreign Animal Diseases i.e. Newcastle disease (PMV-1 in pigeons) and highly pathogenic Avian Influenza often present with neurological signs. This is a result of viral damage to the brain. Marek's disease is one of the most common diseases of chickens. The herpes virus causing Marek's disease may damage the brain directly (encephalitis) or cause tumour formation in the peripheral nerves or other internal organs. Birds with Marek's disease typically are uncoordinated and develop progressive paralysis. Some toxic agents like botulinum toxin (botulism) in game bird operations and waterfowl specifically targets nerve impulse transmission resulting in progressive paralysis. Lead poisoning is a major cause of neurological disease in wild waterfowl. Migrating raccoon roundworm larvae migrating through the brain of ratites commonly causes neurological disease in ratites raised on bedding contaminated with raccoon feces. Nutritional deficiencies including Vitamin E deficiency and thiamine (Vitamin B1) cause neurological disease in fast growing birds. Some of these diseases are discussed in more detail in the disease fact sheets.



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