Rather than a single, defined structure within the brain, the limbic system is a collection of interrelated structures involved in learning, memory, emotional responses, motivation, and primitive drives. Different reference sources include and exclude structures within the limbic system. Some structures share formations or groupings and have additional functions beyond their roles in the limbic system. Generally, the hippocampal formation, amygdala, hypothalamus, and limbic cortex form the limbic system. The limbic cortex includes the fornix, cingulate gyrus, prefrontal cortex, septal area, and parahippocampal gyrus. Closely related structures include the basal ganglia, thalamus, and mammillary bodies. The information reviews the functions, anatomy, and neuroimaging appearances of limbic system components in disease states.

In this section, the limbic-related related functions of the structures are reviewed. Other functions such as their influence on the autonomic nervous system and hormonal secretions not explicitly related to the limbic system are beyond the scope of this paper:
- Hippocampal formation: short-term and immediate explicit memory consolidation into long-term storage
- Amygdala: emotional interpretation of external stimuli and internal states, including fear and aversion responses
- Limbic Cortex
  - Fornix: encoding and recall of new information, as one part within the Papez circuit
  - Cingulate gyrus: selection of appropriate responses to stimuli and projections to other structures within the limbic system
  - Parahippocampal gyrus: processes contextual associations roles in episodic memory and visuospatial processing
  - Entorhinal cortex: sensory input modulation and integration with the hippocampus memory circuits
- Hypothalamus: response coordination to internal and external stimuli, especially in regards to homeostasis and primal drives such as hunger, role in sleep and alertness

MR images that demonstrate the previously described structures:

**Limbic Encephalitis**

MR is the preferred method in evaluation of disease processes that affect soft tissue structures of the brain. MR allows for greater soft tissue contrast between structures than CT allows. Pathologies affecting the limbic system may mimic one another at first inspection. Some methods to clarify a diagnosis include optimized imaging such as different sequences, history and physical exam correlations, or laboratory testing such as serum antibodies, CSF antibodies, CSF cell analysis, and biopsy.

Hippocampal sclerosis, also known as mesial temporal sclerosis, is a condition characterized by neuronal cell loss and gliosis in the hippocampus, particularly in the cornu ammonis regions. It is commonly found in asymptomatic persons at autopsy, but is clinically most associated with temporal lobe epilepsy. Patients with longstanding epilepsy can also demonstrate abnormalities of the structures connected to the hippocampus along the Papez circuit, such as the fornix and mammillary bodies. This suggests that hippocampal sclerosis is in fact a disease involving the entire limbic system.

Hippocampal sclerosis is most demonstrated on MR imaging using a dedicated temporal lobe epilepsy protocol. Characteristic findings include atrophy of the affected hippocampus and hyperintensity on T2-weighted images. Gadolinium is not useful in evaluating hippocampal sclerosis.

Images of a 3-year-old female with Klüver-Bucy syndrome from Ozawa et al. 15

A. Coronal T1 image demonstrating diffuse brain atrophy (DBA), including in the bilateral temporal lobes and hippocampi (arrows). B. Coronal T2 image demonstrating DBA, especially in the bilateral hippocampi.

**Klüver-Bucy Syndrome**

Klüver-Bucy Syndrome (KBS) is a clinical diagnosis characterized by visual agnosia, hyperorality, hypersexuality, placidity, abnormal dietary changes, both atrophy and a hyperintense T2 signal, characteristic of hippocampal sclerosis. Images from Dr Arthur Daire, Radiopaedia.org, rID: 31005.