Pain has been defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage [1]. Conditions of insensitivity to pain are usually discovered before the age of 20 [2], because the absence of any reaction to avoid noxious stimulation results in injuries. In this context, pain and the perception of pain are not isolated phenomena, but parts of regulatory systems that protect the individual against violations of homeostasis. The second aspect of pain is that it disturbs the normal sensory state of a living being. The normal state can be regarded as the normosensoperceptive condition to be maintained in the physiological range by means of various cooperative and coordinated mechanisms (sensory homeostasis).

These two aspects of pain involve two distinct parts of the central nervous system. As Figure 4-1 illustrates, the pain system is hierarchically organized in serial and parallel tracts, and relay nuclei. It also shows that the two parts of the sensory system, referred to as the nociperception and loop system, do not function separately. Functional balance and neuronal connections exist between both parts.

**THE ROLE OF NOCICEPTION IN GENERAL HOMEOSTASIS**

Nociperception is the awareness of pain. This means that a signal generated in the peripheral nerve endings has acted as an input to the integrative circuits of the sensory cortex (see Figure 4-1). The connections that serve this purpose...
include the sensory tracts that synapse in the spinal cord, the nuclei of the brain stem, the sensory nuclei of the thalamus, and the cortex [3]. Noticably, only part of the projections of these systems maintains somatotopic organization.

The medial lemniscus systems synapse in the spinal cord and the sensory information ascend in the somatotopically organized gracile and cuneate fascicles. The fascicles terminate in synapses of the corresponding nuclei in the most caudal part of the medulla oblongata and ascend further in the medial lemniscus [3]. These fascicles and spinothalamic projections have terminal fields organized in clusters in the principal ventroposterolateral nucleus of the thalamus. Similarly, somatotopic organization is maintained in the cortical projections to and within the columns of the primary somatosensory cortex. The protopathic system subserves pain and temperature, and yields ungraded, diffuse impressions of an all-or-none character. The protopathic system is distinguished from the epicritic system, which subserves a discriminative function. The signal transfer of the protopathic system occurs along the spinothalamic tract of the anterolateral system. The terminal fields of this tract are located in the medial division of the posterior group of the thalamus and are not somatotopically organized [3,4]. The spatially separate areas of the thalamus with their different patterns of nerve endings give origin to complementary thalamic outputs to the cortex that maintain the different patterns [5].