CHAPTER 1

GENERAL INTRODUCTION
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Neuroscience deals with the study of brain and nervous system. It covers various aspects of brain involving its structure and its function which is responsible for survival of the animal. The mammalian brain consists of huge number of neurons and glial cells. Neurons are the main signaling unit of the nervous system. It has been seen that neurons form signaling networks which is responsible for the various behaviors. Glial cells perform various vital roles responsible for normal functioning of the brain. The brain has distinct functional regions which are responsible for performing various tasks. Various approaches have been described to study neuroscience. This involves study at the cellular, developmental, structural, functional, evolutionary, computational and medical aspects.

Neurotoxins are substances which produce toxic effect in the nervous system. Neurotoxicity is caused by a vast array of substances mainly pesticides, plant products, heavy metals and various synthetic substances. Conditions associated with damage or dysfunction of the nervous system caused by exposure to neurotoxins may cause a variety of central, peripheral or autonomic nervous system injuries. Neurotoxic injury of central nervous system may further worsen and cause various neurodegenerative diseases.

Brain utilizes 20% of oxygen of that used by the whole animal. Because of high oxygen utilization, brain is vulnerable organ for oxidative damage (Halliwell, 1992). In the field of Neurotoxicology, behavioral study has become important, since it is the outcome of
many complex physiological processes and consequently provides a more comprehensive study (Zala & Penn, 2004).

Plants and herbs have been used by man from time immemorial. Plants have been used for various purposes including medicine and food. Recently Scientists have shown interest in this field and are doing various studies to evaluate the neurotoxicity of these useful plants so that they can be safely used by human being. There are various phytocompounds present in the plant extract responsible for medicinal and toxic property. In various instances it has been shown that there is dose- dependent change in the toxic property. Coscinium fenestratum is a common medicinal plant used in Indo China region. Its stem has been claimed to possess hypotensive, laxative and anti-diabetic activities. The product of this plant is an important therapeutic agent in Sri Lanka. Studies have shown that this plant produces neurotoxicity and also neurobehavioral changes in rats (Wattanathoran et al., 2006). Erycibe obtusifolia is a Chinese medicinal herb found in southern China. The Chinese use it to relieve the symptoms of rheumatoid arthritis. It is useful in the treatment of some myotic and neural dysfunctions and other immune related disease (Ding et al., 1993). According to the Chinese herbal system Erycibe obtusifolia could be toxic in overdoses (Guo, 1994). Erycibe obtusifolia produces toxic effect through functional changes in the liver and kidneys (Hsu et al., 1998). The medical use of the plant Artemisia absinthium is from very early times. In rats neuroprotective properties of this plant has been shown. It has also been suggested to be beneficial in the treatment of strokes. But it has been shown that if threshold concentrations are exceeded, thujone a component in the plant produces
neurotoxic properties leading to seizures in animals. (Lachenmeier, 2010). The castor bean plant (*Ricinus communis*) or wonder tree is found as an ornamental annual plant. It has high traditional and medicinal value for maintaining disease free healthy life. Traditionally the plant is used as laxative, purgative, fertilizer and fungicide etc. The plant also possess beneficial effects such as anti-oxidant, antihistaminic, antinoceceptive, antiasthmatic, antiulcer, immunomodulatory, antidiabetic, hepatoprotective, antifertility, antimicrobial, central nervous system stimulant and many other medicinal properties (Jena and Gupta, 2012). On the other hand the plant belongs to euphorbiaceae family which contain so many toxic plants. The lectin ricin is present in the seeds and pods of the plant. Ricin is considered as one of the most toxic natural poisons (Coopman, 2009). Among various medicinal properties of plants antimicrobial affectivity is also a mostly used property in therapeutics.

Calcium channel blockers (CCB) encompass a heterogenous group of compounds with distinctive pharmacologic characteristics. CCB therapy has an established role in management of hypertension (Sicca, 2006). Desai et al., (1995) reported that CCB display anticonvulsant activity in various models of experimental convulsions. Nimodipine, a dihydropyridine CCB has brain protective effects after a variety of insults (Stève et al., 1992). Milde et al., (1986) reported improved neurologic outcome after global brain ischemia in dogs receiving nimodipine.

Based on the above information three useful medicinal plants were selected from Cachar district of Southern Assam and were evaluated for their neurotoxic property. This was
done by performing neurobehavioural study, biochemical assays of the mice brain tissue, and electron microscopy in the cerebral cortex of the mice brain. Further study was done by administering calcium channel blockers i.e. nimodipine in the mice and it was seen if this attenuates the neurotoxicity produced by the plant extracts.

In this study we have used two regions of mice brain viz. cerebral cortex and midbrain. The cerebral cortex deals with various important functions viz. perceptual, motor functions, memory, emotion and social behaviour. The midbrain contains neurons which coordinates various components of the motor systems viz. cerebellum, basal ganglia. The other functions involves major pathway for controlling eye movements, alertness and hearing.