Gangliosides, sialic acid containing glycosphingolipids, have received much attention owing to their biological functions.1) Meanwhile, it is known that the gangliosides present in echinoderms possess unique structures, 2—4) and therefore they can be expected to represent components of pharmacological interest. A series of studies on the isolation and structural elucidation of gangliosides from echinoderms have been performed in our laboratory, and a ganglioside has been found to support the survival of cultured neuronal cells5) and another ganglioside showed neuritogenic and growth-inhibitory activities toward the mouse neuroblastoma cell line (Neuro 2a).6) In this paper, we report a biological profile on the neuritogenic activity toward the rat pheochromocytoma cell line PC-12 in the presence of nerve growth factor of the so far isolated thirteen gangliosides from echinoderms and their structure–activity relationships.

Experimental

Gangliosides

Gangliosides used in this study were isolated from starfish and sea cucumber species, and their structures are shown in Fig. 1 according to the number of sialic acid. Although the ceramide moieties of the gangliosides of echinoderms have been performed in our laboratory, and a ganglioside has been found to support the survival of cultured neuronal cells5) and another ganglioside showed neuritogenic and growth-inhibitory activities toward the mouse neuroblastoma cell line (Neuro 2a).6) In this paper, we report a biological profile on the neuritogenic activity toward the rat pheochromocytoma cell line PC-12 in the presence of nerve growth factor of the so far isolated thirteen gangliosides from echinoderms and their structure–activity relationships.

Biological Assay

The neuritogenic activity of gangliosides on PC-12 cells was observed according to a method previously reported.7)

Results and Discussion

The effects of the above mentioned gangliosides on the neuritogenesis of a rat pheochromocytoma cell line (PC-12 cells) in the presence of nerve growth factor were investigated. The results show that they displayed neuritogenic activity. Based on the observed results, a structure–activity relationship has been established.

Key words ganglioside; echinoderm; neuritogenic activity; structure–activity relationship

Gangliosides, sialic acid containing glycosphingolipids, have received much attention owing to their biological functions. 1) Meanwhile, it is known that the gangliosides present in echinoderms possess unique structures, 2—4) and therefore they can be expected to represent components of pharmacological interest. A series of studies on the isolation and structural elucidation of gangliosides from echinoderms have been performed in our laboratory, and a ganglioside has been found to support the survival of cultured neuronal cells5) and another ganglioside showed neuritogenic and growth-inhibitory activities toward the mouse neuroblastoma cell line (Neuro 2a).6) In this paper, we report a biological profile on the neuritogenic activity toward the rat pheochromocytoma cell line PC-12 in the presence of nerve growth factor of the so far isolated thirteen gangliosides from echinoderms and their structure–activity relationships.

Fig. 1. Gangliosides from Echinoderms


* To whom correspondence should be addressed.  e-mail: rhiguchi@phar.kyushu-u.ac.jp © 2007 Pharmaceutical Society of Japan
cial role for strong activity as shown in SJG-2 and GAA-7.

(3) When compared the gangliosides possessing tandem disialoyl moiety (LLG-5, LLG-3, HLG-2, LMG-4, and HLG-3), gangliosides having 8-O-Me silalic acid (LLG-5 and LLG-3) showed stronger activity than the other gangliosides.

(4) Comparison of the monosialo-gangliosides indicates that gangliosides possessing sialic acid inside of the oligosaccharide moiety (AG-2 and AG-3) shows more strong activity than those having terminal sialic acid.

(5) The difference of the activity between HLG-1 and SJG-1, despite they have the same sugar moiety, must be occurred from the difference of the structure of their ceramide moieties.

(6) The effect of SJG-2, LLG-5, LLG-3, and GAA-7 are more considerable than that of mammalian ganglioside GM1, which has been known to show positive effects in neurological diseases.

On the other hand, these gangliosides showed no activity without NGF. Therefore, it is suggested that these gangliosides are potentiated neuritogenesis activity of NGF.

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