

Recent Research Highlights in:

Biological Sciences

Natural Products Chemical Biology and the Creation of Nerve Regeneration Compounds

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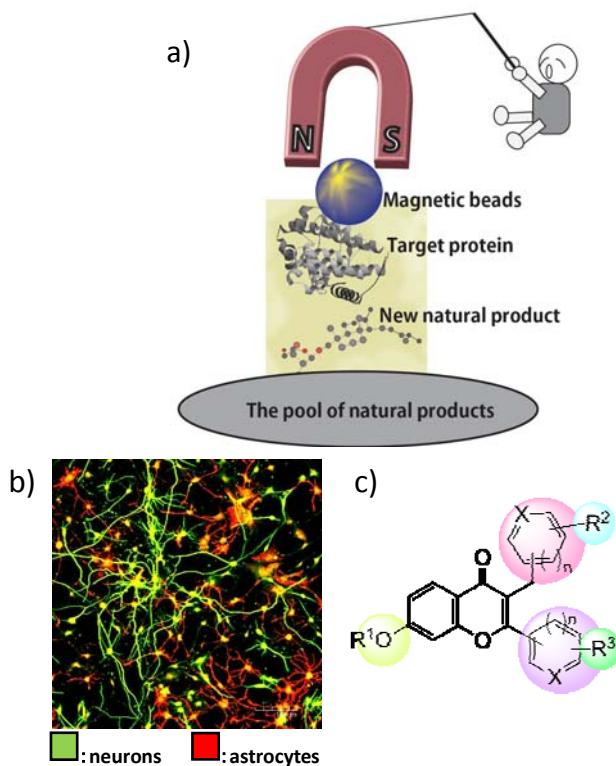
Background of Research

Neural stem cells have been discovered that can generate new neurons in the human brain. There are hopes that by activating these neural stem cells it will be possible to make up for those neurons that are lost through strokes or damaged through diseases of the brain. Chemical biology is an area of research that uses chemistry to understand biological phenomena. Our particular research involves investigating products and compounds existing in the natural world that may serve as sources of medicines that will provide strong support for the capacity of human nerves to achieve regeneration and recovery.

Results from this research

Many important medications, such as the immunosuppressant drugs used in organ transplants, are derived from such natural products. Our team of researchers has developed an efficient method for discovering bioactive natural products that activate the differentiation of neural stem cells into neurons (Fig. 1-a). A protein is fixed to a magnetic bead stuck onto a magnet and, just like fishing with a rod, this method yields particular information about those natural products which bind to the target protein from a pool of natural products. By using this method, we can identify bioactive natural products with high-efficiency. This “pool” is an extract of natural materials such as plants and microorganisms, and it contains many different natural products. By binding natural products to those proteins that suppress the differentiation of neural stem cells, this method proved to be efficient at isolating those natural products that hindered the working of those

proteins. These natural products activated the differentiation of neural stem cells into neurons, causing a major extension in the neuronal process (Fig. 1-b). We also efficiently synthesized new chemical compounds that made use of the core structure of natural products, and found inhibitors of the hedgehog signaling which is related to nerve regeneration (Fig. 1-c). Also, this signaling increases in many cancers, and is attracting attention as a target for new cancer treatments. Our team is also discovering many hedgehog signaling inhibitors from natural products.



▲ Fig.1-a) Protein immobilized for search of bioactive natural products, b) Neural stem cell differentiation was activated by a natural product, c) Synthesized natural products-like compounds

Prospective developments

We are tackling the issue of nerve regeneration along the multiple paths of chemical synthesis, protein and cell assay systems, and isolating natural products. We believe that this sort of natural products chemical biology, which is only possible in the realm of university research, can deliver the compounds and phenomena needed for nerve regeneration treatments.