Engineered Hagfish Proteins as Neuroprotective and Bioactive Substrates for Neural Regeneration

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Biotech & Life Science

Abstract

This technology uses recombinant hagfish proteins and spider silk proteins to create a viable process for neural regeneration.

Problem

More than 3 billion people suffer from neurological disorders caused by damage to neurons. Limited treatments for these disorders exist.

Solution

This technology combines the regenerative properties of hagfish slime proteins and spider silk proteins to stimulate regrowth of neurons.

Value Proposition

This technology has potential to provide treatment for neurodegenerative disorders and serve as a nerve model for study neural cell behavior.

Benefit

Billions of people suffer from neurologic damage and disorders. These are most often caused by damage to neurons, whether by age, injury, or illness. Neurons of the central nervous system do not regrow once damaged, and those of the peripheral nervous system have limited recovery as well, thus limiting treatment options for such ailments.

USU researchers have developed a process to promote cell regeneration using recombinant hagfish and spider silk proteins. Neural cells grown on these protein films show high viability, enhanced neurite outgrowth, and increased cell attachment. The cells grown on these protein films exhibit neuroprotective properties, as evidenced by reduced intracellular reactive oxygen species levels. The grown neural cells may be used to treat neural injuries and neurodegenerative diseases.

This technology’s approach minimizes batch-to-batch variations, allowing for more consistent results and provides a more biomimetic and bioactive option for neuronal growth compared to competitors. The unique properties of the neural cells, including exceptional tunability, high-yield expression with minimal batch-to-batch variability, and scalable purification methods, also make them ideal candidates for creating advanced neural tissue models. These characteristics position the engineered proteins as promising high-yield, bioactive substrates for neural tissue engineering, offering innovative approaches for both research and potential treatment options in neuroscience and regenerative medicine. Furthermore, the proteins' potential extends to the development of nerve guidance conduits for translational medicine. These conduits could serve as crucial tools in nerve grafting procedures and the repair of traumatic injuries, offering a biocompatible and biomimetic environment that promotes directed neural growth and regeneration.

Market Application

This technology bridges the neuroscience and regenerative medicine markets. It can be applied as a tool to facilitate neural regrowth and to create advanced nerve models for studying neural cell behavior, differentiation, and network formation.

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Intellectual Property

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