Viruses that cure rather than spread diseases  
*IBN scientists discover breakthrough method to treat neuronal diseases*

SINGAPORE – What do stroke, epilepsy, head or spinal cord trauma, Parkinson’s disease and Alzheimer’s disease patients have in common? They all suffer from neuronal cell death brought about by the absence or malfunction of specific genes.

For these patients, hope lies in gene therapy research, whereby scientists study ways to replace the abnormal or disease-causing gene with a normal gene. In order to deliver the therapeutic gene to the patient’s target cell, scientists need to use gene carriers called vectors.

The most common type of vectors used is the viral vector. Viruses conventionally spread diseases in the human body by delivering their genes to human cells. In gene therapy studies, scientists use this natural ability of viruses and manipulate the virus genome to remove the disease-causing genes and insert therapeutic genes.

The widespread distribution of affected neurons and the relatively inaccessible location of neurons in certain neurological disorders present obstacles to effective gene therapy. Several virus vectors are capable of overcoming these problems by using the body’s natural process of axonal transport, which allows them to migrate from a remote point of entry to target cells that are located deep within the nervous system.

“The use of axonal transport for neuronal gene transfection allows viral vectors to target neurons in remote parts of the circuit,” explains Dr Wang Shu, Group Leader of IBN’s Gene Delivery Group. “By injecting the virus into the body in a more accessible region, we can target other neurons deep within the central nervous system or minimize the damage to sensitive regions, which may be caused by the injection procedure.”

To date, viruses that can be transported via axonal transport, such as the adenovirus and HSV (herpes virus), have elicited strong immune and inflammatory responses from the body, presenting a setback to researchers. However, a new discovery by IBN’s Gene Delivery Group promises new hope for viral-based gene therapy.

Recently, Dr Wang Shu and his team at IBN have invented a new method for
delivering a baculoviral vector to target cells in the central nervous system by axonal transport.

“Baculoviruses are relatively safe and do not cause as much damage to the body compared to the adenovirus and the herpes simplex virus,” explains Dr Wang Shu. “We have demonstrated for the first time that recombinant baculoviral vectors can migrate by axonal transport to neuronal cell bodies, resulting in transgene expression in projection neurons.”

Other than its potential for use in treating neurological diseases, this invention may also be used to trace neuronal pathways. By using a baculovirus that has been genetically modified for detection purposes, scientists can also view the transport path of the virus within a subject’s central nervous system.

Dr Wang Shu’s group is now working on tests using animal models of Parkinson’s disease. The outcome of their research will shed greater light on gene therapy of the disease and other neurological illnesses.

For more information on IBN, please log on to: http://www.ibn.a-star.edu.sg

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ANNEX

About the Institute of Bioengineering and Nanotechnology (IBN)

The formation of IBN, formerly known as the Institute of Bioengineering, was endorsed by the International Advisory Council for Singapore’s Biomedical Sciences in March 2002.

Massachusetts Institute of Technology Professor Jackie Yi-Ru Ying, 37, was hand-picked by A*STAR chairman Philip Yeo to lead the institute as its Executive Director in March 2003.

Under her direction, IBN, one of the five biomedical research institutes at A*STAR, conducts research at the cutting-edge of bioengineering and nanotechnology. Its programmes are geared towards linking multiple disciplines across all fields in engineering, science and medicine to produce research breakthroughs that will improve healthcare and quality of life.

IBN’s six research areas are Nanobiotechnology; Delivery of Drugs, Proteins and Genes; Tissue Engineering; Artificial Organs and Implants; Medical Devices; as well as Biological and Biomedical Imaging.

IBN’s innovative research is aimed at creating new knowledge and intellectual properties in the emerging fields of bioengineering and nanotechnology. This will attract top-notch researchers and business partners to Singapore.

IBN will also play an active role in technology transfer and spinning off companies, linking its research institute and industrial partners to other global institutions.

As of August this year, IBN’s staff strength stands at 120. By December 2006, it plans to expand to 250 staff to create a talent pool for new businesses and R&D centres. With its multi-national research staff, the institute is geared towards generating new biomaterials, devices, systems, equipment and processes to boost Singapore’s economy in the fast-growing biomedical sector.

IBN is also committed to nurturing young minds, and the institute will act as a training ground for PhD students and undergraduates. Its Youth Research Programme also opens the institute’s doors to university students here, as well as students and teachers from various secondary schools and junior colleges.