Press Release – Science

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Most important actors in the growth process of neurons identified

Leuven, Belgium – Defects in the growth process of our neurons often underlie brain or nerve diseases, such as Alzheimer's disease or multiple sclerosis. Scientists from the Flanders Interuniversity Institute for Biotechnology (VIB) connected to the Katholieke Universiteit Leuven, led by Bassem Hassan, have achieved a major step in unraveling the growth process of axons, the offshoots of neurons. They have identified the JNK, Wnt and FGF signaling cascades as the most important actors and have also discovered their respective roles. Their research shows that the growth of axons and the activity of neurons are completely independent of each other. This new finding can lead to better understanding of a variety of nerve diseases.

A complex network

A human being has approximately 100 billion **neurons**, the body's information and signal processors. The great majority of them are found in the central nervous system. The brain contains complex networks of neurons that regulate a large number of bodily functions. Because the brain and the nervous system are a delicate system, something can sometimes go seriously wrong and a brain or nerve disease appears – for example, Alzheimer's or Parkinson's disease, Amyotrophic Lateral Sclerosis (ALS), or Multiple Sclerosis (MS). In the quest for possible cures for these diseases, it is important that we understand how connections are established between neurons.

Neurons have a number of long thin offshoots – called **axons** – that conduct electrical impulses. These primary elements of information transfer in the nervous system can sometimes be more than a meter long. The axon's orientation as it grows is also of great importance in forming the right connection. As in-coming stimuli are converted into signals that determine the direction and speed of an axon's growth, three things can happen: the axon can grow further, pull back, or change direction. Therefore, axon growth is a process that consists of several components: growth of the axon, orientation, recognition of objectives, and finally formation of synapses in order to transmit stimuli. Unraveling precisely how this whole process works is important for understanding the development of the brain and for helping develop therapies for diseases that are the consequence of damaged or diseased neurons.

The fruit fly as model

Bassem Hassan is using the fruit fly (*Drosophila melanogaster*) as model for his research. Many processes in this small fly are in fact comparable to processes in humans, even for something as complex as the nervous system. Axon growth is a complicated process in that it involves growth as well as orientation and recognition. So it's not surprising that many different genes are involved. To bring clarity to this complex organization, **Mohammed Srahna** and his colleagues, led by Bassem Hassan, have been studying the **DCN** (Dorsal Cluster Neurons), a group of cells in the fruit fly's brain. The DCN belong to the visual system of the adult fruit fly and stimulate the visual cortex. The axons of the DCN form a very stereotypical connection pattern. This well-ordered pattern gave the researchers the perfect starting point for studying the influence of various genes on the axon growth process.

Regulation by several genes
From their study of the developing brain of an adult fruit fly, the researchers have found that axon growth is mediated by an interaction among three signal cascades: **Wnt**, **FGF** and **JNK**. JNK is necessary for stimulating the growth of axons. Wnt activates JNK and FGF inactivates JNK, so the right balance between Wnt and FGF provides for a precise regulation of the growth of neurons. Axonal growth turns out to be completely independent of neuronal activity. This finding brings greater clarity to the axon's growth process – knowledge that constitutes a major step forward in understanding neuronal disorders.

Given that this research can raise a lot of questions for patients, we ask you to please refer questions in your report or article to the email address that VIB makes available for this purpose: patienteninfo@vib.be. Everyone can submit questions concerning this and other medically-oriented research directly to VIB via this address.

Relevant scientific publication
This research appears in the authoritative journal *PLoS Biology* (Srahna *et al.*, A signaling network for patterning neuronal connectivity in the *Drosophila* brain; *PloS Biology*, 2006).

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Note to the Editor
VIB, the Flanders Interuniversity Institute for Biotechnology, is a research institute where 900 scientists conduct gene technological research in a number of life-science domains, such as human health care and plant systems biology. Through a joint venture with four Flemish universities (Ghent University, the Katholieke Universiteit Leuven, the University of Antwerp, and the Vrije Universiteit Brussel) and a solid funding program for strategic basic research, VIB unites the forces of nine university science departments in a single institute. Through its technology transfer activities, VIB strives to convert the research results into products for the benefit of consumers and patients. VIB also distributes scientifically substantiated information about all aspects of biotechnology to a broad public.

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