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PD Map: Putting together the pieces of the Parkinson's puzzle

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Parkinson's disease continues to puzzle physicians and biologists alike - even though it is well-established that symptoms like muscle tremors, rigidity, and, during the final stages, immobility can all be traced back to the death of a certain type of brain cell called a dopaminergic neuron. The underlying cause of this cellular death is a complex web of interrelated genetic molecular processes as well as external factors, most of the details of which are well-known. But how the various factors correlate and influence each other continues to elude the scientific community. Now for the first time ever, researchers at the Luxembourg Centre for Systems Biomedicine (LCSB) at the University of Luxembourg have published an interactive picture containing the current knowledge about the underlying genetic and molecular causes of Parkinson's disease. This "Parkinson's disease map," or "PD Map" for short has been published in the scientific journal *Molecular Neurobiology*. It will facilitate the systematic study of PD through a newly gained clarity of the existing knowledge about the disease.

"Indeed, biomedical research continuously gives us many new insights about Parkinson's." says Dr. Marek Ostaszewski, coordinator of the LCSB PD Map project. "Each year, thousands of new scientific publications appear on the subject - yet no single individual could possibly hope to keep a detailed track of this flood of information." All of this knowledge has to be sorted, meaningfully correlated, and continually refined to ultimately benefit patients.

Ever since the Centre's founding four years ago, the LCSB scientists

have made it a point to develop this disease overview and put it in a useful format of an interactive map available to both researchers and clinicians. In developing the map, the LCSB scientists worked closely with their colleagues at the Systems Biology Institute (SBI) in Tokyo, Japan. The SBI researchers already created a number of similar virtual maps of complex molecular processes and have extensive experience with the systematic analysis and mapping of existing knowledge. The LCSB was able to build on this experience and has put together a similar map, albeit of a complex disease.

Marek Ostaszewski sums up the most important benefit of the PD Map: "By uniting the existing knowledge about PD, the map sheds light on the connections between pieces of the puzzle nobody had thought existed - and which will form the basis for brand new research hypotheses." To the biological scientists the PD Map helps pinpoint the gaps in our current understanding of Parkinson's. Adds Ostaszewski: "We can more accurately identify pathological mechanisms that are incompletely understood and where more scientific work is needed. On this basis, research hypotheses can be established and verified by highly focused laboratory experiments."

Prof. Dr. Rudi Balling, director of LCSB, says: "For us at the LCSB but also for many other research institutes, the map offers many impulses for further scientific investigation. There's a genuine interest on the part of the scientific community; other research institutes should benefit from it, and at the same time contribute their own expertise." An important area, where the map needs to reach out is clinical research. LCSB's efforts in this direction are greatly supported by the IBBL (Integrated Biobank of Luxembourg). Marek Ostaszewski says: "IBBL brings in invaluable expertise in developing and providing technologies as well as infrastructures for clinical science. Additionally IBBL enormously facilitates the dialogue between basic researchers and clinicians".

Of course, the contents of this recently established overview must remain fresh, and suitable tools need to be developed to integrate newly gained knowledge into the map. To Ostaszewski, the obvious solution is crowd sourcing. The basic idea is similar to how Wikipedia works: an online portal that scientists can use to simultaneously feed in their knowledge and which helps the map expand much more quickly than if just one single institution like the LCSB were to try and do it all. It's important the new entries are checked and carefully evaluated: "Every Parkinson's researcher has a special focus and considers his or her own research to be the most important," explains Ostaszewski. "A good web portal will allow everyone to tend to their own little garden, so-to-speak, while ensuring the information is correctly categorized and meaningfully correlated."

A major challenge is ensuring the map content is readily accessible at all times using your web browser - and that it is intuitive. Adds Rudi Balling: "Only then will researchers in the basic sciences and clinicians be able to incorporate the map into their daily work - and use it to come up with new approaches to the prevention, diagnosis, and therapy of Parkinson's."

More information: Fujita, K. et al. Integrating Pathways of Parkinson's Disease in a Molecular Interaction Map, *Molecular Neurobiology*, 2013. DOI: 10.1007/s12035-013-8489-4

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