FEDERATION OF EUROPEAN NEUROSCIENCE SOCIETIES
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PRESS RELEASE
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HOW DOES OUR BRAIN TELL THE TIME?

Decisions based on timing are critical for survival, and we see the impact of impaired ability to time movements in debilitating conditions such as Parkinson's Disease (PD). Presenting at the FENS Forum of Neuroscience in Berlin today (9 July), two researchers reported studies investigating the physical and chemical circuitry within the brain that enables timing and co-ordination of movement, with implications for new treatments for PD and related conditions.

Affecting more than 10 million people across the world, PD affects our movements in many ways, from tremor in the hands to slowed movement, rigid muscles and changes in speech.

Dr Nandakumar Narayanan from the University of Iowa, USA, will describe his studies with rat models and human subjects showing that timing within the brain can be altered by drugs that target the brain chemical or neurotransmitter dopamine. Levels of dopamine are known to be reduced in PD, and increased in schizophrenia, another condition where timing within our brains seems to go awry.

Dr Narayanan has found that receptors for dopamine in the brain's frontal cortex are critical for timing, in a way that is highly conserved across species, and attenuated in human patients with schizophrenia and Parkinson's disease as well as in animal models. "We can stimulate dopamine receptors in various brain regions in such a way that we compensate for the sort of movement deficit we see in Parkinson's disease, and improve timing of movement in patients with the condition. These data provide a window into understanding temporal processing by brain circuits and could have relevance for new therapies for human disease," he said.

In related work, Dr Lucille Tallot in Dr Valérie Doyère's laboratory of the Paris-Saclay Institute of Neuroscience in France is using rat models to probe more deeply the physical nature of these brain networks. "Timing is internally generated within our brains, and in many conditions, such as Parkinson's or schizophrenia, this signalling can go wrong. I am interested in the basic structures within which timing is managed by the brain," she explained.

Dr Tallot uses experiments that track changes in the connectivity in rats between three brain areas, the amygdala, the striatum and the prefrontal cortex, in relation to specific stimuli that the animals find either unpleasant or rewarding. At FENS, she presented a series of experiments that show how these brain structures interact during learning about the interval between stimuli, with the implication that the network plays a critical role in how the brain keeps track of time and is enabled to learn about and respond to specific events.

END

Symposium: S25 Neural encoding of time on the scale of seconds: Networks for time-based anticipation and action
Abstracts: N. Narayanan **-** Dopamine, delta rhythms, and interval timing
L Tallot & V Doyère **-** Amygdalo-striatal networks and temporal expectancy

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NOTES TO EDITORS
Dr Nandakumar Narayanan, Department of Neurology, University of Iowa, USA http://www.healthcare.uiowa.edu/labs/narayanan/
Dr Lucille Tallot, Paris-Saclay Institute of Neuroscience, France
http://neuro-psi.cnrs.fr/spip.php?lang=en
(Dr Valérie Doyère is unable to attend the FENS Forum. Dr Lucille Tallot will present their research.)

The 11th FENS Forum of Neuroscience, the largest basic neuroscience meeting in Europe, organised by FENS and hosted by the German Neuroscience Society will attract more than 7,000 international delegates. The Federation of European Neuroscience Societies (FENS) was founded in 1998. With 43 neuroscience member societies across 33 European countries, FENS as an organisation represents 24,000 European neuroscientists with a mission to advance European neuroscience education and research. https://forum2018.fens.org/

Further reading (Nandakumar)
A human prefrontal-subthalamic circuit for cognitive control. R Kelley, O Flouty, E Emmons, Y Kim, J Kingyon, J Wessel, H Oya, J Greenlee and N Narayanan *BRAIN* 2018: 141; 205–216 **DOI:10.1093/brain/awx300**