same animals. Overall, our findings suggest that LTP of the EC input increases the excitation/inhibition balance, and facilitates activity propagation to the next station in the circuit by recruiting an interneuron-interneuron network that inhibits the tight control of basket cells over DGgc firing.

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Neuroscience gateway enabling modeling and data processing using high performance and high throughput computing resources

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The Neuroscience Gateway (NSG) has been serving the computational neuroscience community since early 2013. Its initial goal was to reduce technical and administrative barriers that neuroscientists face in accessing and using high performance computing (HPC) resources needed for large scale neuronal modeling projects. For this purpose, NSG provided tools and software that require and run efficiently on HPC resources available as a part of the US XSEDE (Extreme Science and Engineering Discovery Environment) program that coordinates usage of academic supercomputers. Since around 2017 experimentalists such as cognitive neuroscientists, psychologists and biomedical researchers started to use NSG for their neuroscience data processing, analysis and machine learning work. Data processing workloads are more suitable on high throughput computing (HTC) resources that are suitable for single core jobs typically run to process individual data sets of subjects. Machine learning (ML) workloads require use of GPUs for well-known ML frameworks such as TensorFlow. NSG is adapting to respond to the needs of experimental neuroscientists by providing HTC resources, in addition to already enabling successfully the computational neuroscience community for many years by providing HPC resources. Data processing focused work of experimentalists also require NSG to add various data functionalities, such as ability to transfer/store large data to/on NSG, validate the data, process same data by multiple users, publish final data products, visualize the data, search the data etc. These features are being add to NSG currently. Separately there is a demand from the neuroscience community to make NSG an environment where neuroscience tool developers can test, benchmark, and scale their newly developed tools and eventually disseminate their tools via the NSG for neuroscience users.
The poster will describe NSG from its beginning and how it is evolving for the future needs of the neuroscience community such as: (i) NSG has been successfully serving primarily the computational neuroscience community, as well as some data processing focused neuroscience researchers, until now; (ii) new features are added to make it a suitable and efficient dissemination environment for lab-developed neuroscience tools. These will allow tool developers to disseminate their lab-developed tools on NSG taking advantage of the current functionalities that are being well served on NSG for the last seven years such as a growing user base, an easy user interface, an open environment, the ability to access and run jobs on powerful compute resources, availability of free supercomputer time, a well-established training and outreach program, and a functioning user support system. All of these well-functioning features of NSG will make it an ideal environment for dissemination and use of lab-developed computational and data processing neuroscience tools; (iii) NSG is being enhanced such that it can have more seamless access to HTC resources provided by the Open Science Grid (OSG) and commercial cloud. This will allow data processing and machine learning oriented workloads to be able to take advantage of HTC and cloud resources including GPUs; (iv) New data management features are being added to NSG and these include the ability to transfer/upload large data, validate uploaded data, share and publish data etc.

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Effects of dopamine on networks of barrel cortex

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The responses of excitatory pyramidal cells and inhibitory interneurons in cortical networks are shaped by each neuron's place in the network (connectivity of the network) and its biophysical properties (ion channel expression [1]), which are modulated by top-down neuromodulatory input, including dopamine. Using a recently developed ex vivo method [2], we showed that the activation of the D1 receptor (D1R) increases the information transfer of fast spiking, but not regular spiking, cells, by decreasing their threshold [3]. Moreover, we showed that these differences in neural responses are accompanied by faster decision-making on a behavioural level. However, how the single-cell changes in spike responses result in these behavioural changes is still unclear. Here, we aim to bridge the gap between behavioural and single cell effects by considering the effects of D1R activation on a network level.
We took a 3-step approach and simulated the effects of dopamine by lowering the thresholds of inhibitory but not excitatory neurons:
1) Network construction. We created a balanced network of L2/3 and L4 of the barrel cortex, consisting of locally connected integrate-and-fire neurons. We reconstructed the somatosensory cortex in soma resolution ([4], Fig. 1A), and adapted the number and ratio of excitatory and inhibitory neurons and the number of thalamic inputs accordingly.
2) Activity of the balanced state. The adaptations in the neural populations and connectivity resulted in a heterogeneous asynchronous regime [5] in L2/3, with highly variable single-neuron firing rates and suggesting a functional role of stimulus separation, and a 'classical' asynchronous regime in L 4, with more constant firing rates and suggestive of an information transmission role (Fig. 1B).
3) Functional effects. We used a spike-based FORCE learning [6,7] application, trained on either a gap-crossing task (data from [8]) or on a pole detection task (publicly available data from [9], Fig. 1C). We compared the results against a benchmark test consisting of a 3-layer deep neural net with a recurrent layer.