

Highlights...

- Dr. Samarjit Bhattacharyya joins SANKET
- Updates from GSoC-2019
- Updates on the findsim interface
- "Computational investigation of Smooth Muscle Syncytium"
- Dr. Shailesh Appukuttan

**Participating labs:**

Upinder Bhalla, NCBS
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 Rohit Manchanda, IITB
 Sourav Bannerjee, NBRC
 Raghu Padinjat, NCBS
 Deepak Nair, IISc
 Srinivasa Chakravarthy, IITM
 Rishikesh Narayanan, IISc
 Shailesh Appukuttan, CNRS
 R Srivatsan, IBAB
 Samarjit Bhattacharyya, IISER Mohali

General Consortium News

With great pleasure, we welcome Dr. Samarjit Bhattacharyya to SANKET team. Dr. Bhattacharyya is interested in investigating cellular and molecular mechanisms of protein trafficking in the central nervous system. Currently, he is the head of the department of Biological Sciences at IISER Mohali.

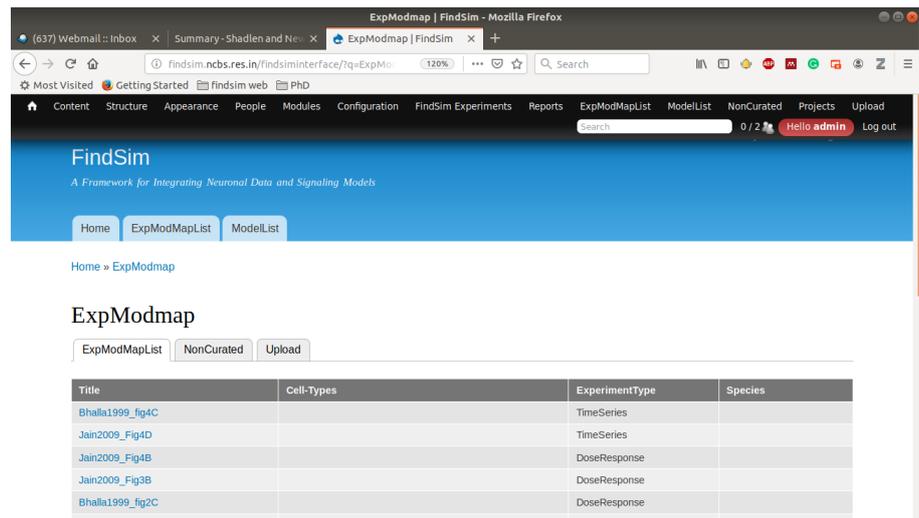
A draft version of the documentation for the findsim portal is now available at <https://github.com/BhallaLab/FindSim/wiki>.

The GSoC 2019 student - Chen has started working on the API development to integrate findsim website with the [Neuroscience Gateway](#) (NSG) server. NSG is a HPC cluster hosted at San Diego Supercomputing Centre.

**Updates on Websites**

We have enabled permissions for user accounts on the portal. Anyone with a valid email id can create an account. Logged-in users are allowed to create, save and run findsim experiments. As per the requirement of the consortium, we will have three levels of resources sharing.

1. Private: only the owner can access and edit the private resources.



2. Project: We allow users to create projects in the portal. Soon, we will enable adding other users to the project. The experiments and models in a project will be accessible to other users added to the project but can be edited only by the owner of the particular experiment/model. We will allow other users to make a copy of the shared experiments and models in case they would like to edit them.

3. Public: Once an experiment/model is curated, the user can publish it which will add the experiment/model to the curated list visible to the general public. Accessing public resource will not require any log-in. Moreover, if a user wants to edit a publically available experiment/model, he/she can do so by making a copy of it in their account and then modify their copy.

Work from participating labs

Dr. Shailesh Appukuttan worked in the Computational NeuroPhysiology Lab (CNPL) with Prof. Rohit Manchanda at IIT Bombay till 2017, where he worked on the computational investigation of electrical properties in smooth muscle syncytia. He is currently working on the Human Brain Project (HBP) in the Neuroinformatics team of Dr. Andrew Davison at ICN (formerly UNIC) CNRS, Paris, and is involved in the development of a framework for the systematic statistical validation of data-driven models in neuroscience. He provides an overview of these two projects below:



Computational Investigation of Smooth Muscle Syncytium

Certain smooth muscles, such as the detrusor of the urinary bladder, exhibit a variety of spikes that differ markedly in their amplitudes and time courses. The origin of this diversity is poorly understood but is often attributed to the syncytial nature of smooth muscle and its distributed innervation. In order to help clarify such issues, they developed a 3D electrical model of syncytial smooth muscle with special reference to the bladder detrusor. The model was validated against various experimental results and found to accord with both theoretical predictions and experimental observations. Model outputs also satisfied criteria characteristic of electrical syncytia, such as correlation between the spatial spread and temporal decay of

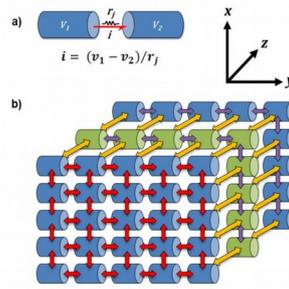


Figure 1: Simplified representations of (a) gap junction between two cells. The gap junctional current is determined by the potential gradient between the cells and the resistance offered by the gap junction. (b) arrangement of cells in a 3-D syncytium.

electrotonic potentials as well as positively skewed amplitude frequency histogram for sub-threshold potentials, and led to interesting conclusions. Set against experimental results, they conjectured the existence of electrically sub-infinite bundles in the detrusor. Moreover, the absence of coincident activity between closely spaced cells potentially implies, counter-intuitively, highly efficient electrical coupling between such cells. The model thus provides a heuristic platform for the interpretation of electrical activity in syncytial tissues. A number of enhancements and extensions to the basic model have been developed to obtain a better understanding of syncytial tissues. These include the investigation of initiation, propagation and modulation of action potentials in a syncytium and the development of a physiologically more realistic gap junction model.

Model Validation Framework for Neuroscience

The expansion of knowledge in neuroscience has resulted in a myriad of models to represent the multi-level complexity of the

brain. An essential element of scientific modeling is validation of the model with respect to experimental data. Until recently this has most often been done in an ad hoc manner, with most studies reporting only qualitative comparisons between simulation results and experimental findings, and usage of different datasets for validation, which makes comparison of models difficult. By defining interfaces to which models must adhere, tests can be model agnostic and used to validate any compatible model despite differences in their internal structures, the language used and/or the simulator employed. Suites of validation tests for biophysically and morphologically detailed neuron models, and for circuit models of different brain regions have been developed, along with a web services framework to support the management of models, tests, and validation results. The framework enables tracking the evolution of models over time, as well as comparison against other models in the domain.

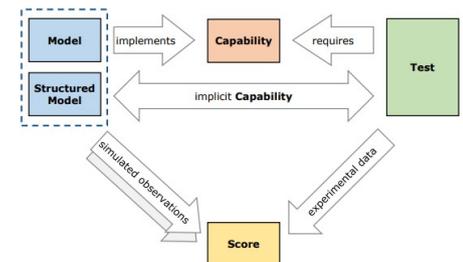


Figure 2: The framework decouples the validation test definition from the model implementation. This allows testing of different models without having to re-write the validation tests. It achieves this through the concept of Capabilities, which are basically interfaces through which the model and the validation tests can communicate