

Survey of ModelDB entries that were published from 2013-present

Subcellular mechanisms

Synaptic transmission

Mechanism of transmitter release: 182142 (Keller et al. 2015)

Functional consequences of synaptically-induced conductance changes: 152539 (Cavallari et al. 2014)

Focal inhibition of excitatory input onto individual spines: 143604 (Chiu et al. 2013)

Plasticity: interaction of multiple forms of short term synaptic plasticity 152200 (Zhou et al. 2014), effect of initial synaptic state on induction of LTP and LTD 157339 (Migliore et al. 2015), dopamine-dependent plasticity at corticostriatal synapses 151458 (Nakano et al. 2013), Gq coupled signaling pathways involved in striatal synaptic plasticity 154967 (Kim et al. 2013), effect of calcium waves on mGluR-dependent synaptic plasticity 150551 (Ashhad and Narayanan 2013)

Roles of intra- and extracellular ionic concentrations in neuronal function

Calcium waves: 168874 (Neymotin et al, 2015), 150551 (Ashhad and Narayanan 2013)

Other calcium fluctuations: calcium influx during striatal upstates (Evans et al. 2013)

Effects of Na and K concentration changes on cellular dynamics: 167714 (Hubel and Dahlem, 2014), 169023 (Krishnan et al. 2015)

Regulation of extra- and intracellular milieu

Astrocytic regulation of extracellular ionic concentrations: 151945 (Halnes et al. 2013)

Intracellular movement of proteins: electroosmosis 147740 (Andreev 2013), microtubular transport of kinases 153740 (Koon et al. 2014)

Cellular properties and phenomena

Cellular morphology (also see **Synthesis of model neurons and networks)**

Mechanisms that govern development of individual neurons: 152788 (Hjorth et al 2014)

Effects of morphology on function: dendritic excitability 146509 (Ferrante et al., 2013), synaptic integration 156828 (Simoes_De_Souza et al. 2014), calcium dynamics 155731 (Anwar et al. 2014)

Physiology of particular cell classes

Information processing in individual neurons: cerebellar granule cells 156733 (Rossert et al. 2014)

Excitability: motoneurons 180370 (Balbi et al, 2015), dorsal reticular nucleus neurons (Sousa et al., 2014), myenteric sensory neurons 155796 (Chambers et al. 2014)

Factors that affect cellular excitability and spontaneous activity

Potassium channels: pituitary lacto-somatotroph cells 154955 (Vo et al 2014), excitability of dentate granule cells 169240 (Mateos-Aparicio et al., 2014)

Experience-driven modulation of intrinsic excitability: 155131 (Scheler 2014)

Hormonal modulation of neuronal excitability: angiotensin II 156830 (Makadia, Anderson, Fey et al., 2015)

Dendritic excitability

Effect of dendritic structure on spike initiation and propagation: branch point morphology 146509 (Ferrante et al., 2013)

Ionic mechanisms: 151825 (Almog and Korngreen 2014)

Local dendritic spikes: spatially localized synaptic integration 167694 (Behabadi and Mel 2014)

Roles of dendritic excitability: in sensory integration 180373 (Shai et al., 2015), persistent activity and working memory 155057 (Papoutsis et al. 2014, 2013), and function of cortical microcircuits 156780 (Hay and Segev 2014)

Networks and systems

Plasticity and network development, function, and maintenance

"Learning" network architecture by activity combined with plasticity: connectivity motifs from interaction of network activity with short- and long-term synaptic plasticity 150211 (Vasilaki, Giugliano 2014), retinotopic maps 183251 (Hjorth et al. 2015), cortical color opponent receptive fields 152197 (Eguchi et al., 2014), balanced networks 182784 (Sadeh et al, 2015), visual system changes induced by visual deprivation 180791 (Toyoizumi et al. 2014), olfactory bulb circuitry 151681 (Migliore et al. 2014), self-organized olfactory pattern recognition 155157 (Kaplan and Lansner 2014), auditory circuitry for detecting sliding pitch 168407 (Skorheim et al. 2014), grid cells from place cells 150846 (Castro and Aguiar, 2014),

Network homeostasis: mediated by adjustment of neural excitability through diffusion of nitric oxide 183371 (Sweeney et al. 2015)

Network stabilization by short term synaptic depression: 168314 (Hummos et al 2014)

Functional consequences of multiple distributed mechanisms for synaptic plasticity: adaptive gain control 149913 (Garrido et al., 2013), fast convergence of cerebellar learning 150225 (Luque et al. 2015)

Subcellular mechanisms of network plasticity embedded in network architecture: endocannabinoids and Gq-coupled signaling in striatum 154967 (Kim et al. 2013)

Inhibition in networks

Role of parvalbumin-positive basket cells in hippocampus 153280 (Lee et al. 2014)

Roles of different interneuron classes in persistent activity 168310 (Konstantoudaki et al 2014)

Stabilization of Ca3 region of hippocampus 168314 (Hummos et al 2014)

Sensory processing

Olfaction

Peripheral receptors: transduction and adaptation in olfactory cilium 151686 (Antunes et al 2014)

Network models of olfactory system: odor coding by microcircuits 153574 (Gilra and Bhalla 2015), olfactory bulb circuits for determination of odor identity and intensity 168418 (Polese et al. 2014), response to time-varying odor stimuli in juxtglomerular models 15211 (Carey et al., 2015), self-organization of pattern recognition in model of olfactory bulb plus pyriform cortex 155157 (Kaplan and Lansner 2014), experience-driven formation of network architecture in a large scale 3D model of olfactory bulb 151681 (Migliore et al. 2014), role of polysynaptic facilitation in olfactory processing in a pyriform cortex - hippocampus model 181032 (Trieu et al 2015)

Modulation of olfactory processing: adenosine effects in a pyriform cortex - hippocampus model 181032 (Trieu et al 2015), cholinergic neuromodulation of olfactory processing in olfactory bulb 149739 (Li and Cleland 2013), cholinergic modulation of odor learning in olfactory bulb and pyriform cortex 146813 (de Almeida et al. 2013; Devore S, et al. 2014)

Vision

Roles of specific cell classes in visual processing: fly vertical system tangential cells and sensory coding 155727 (Trousdale et al. 2014), excitable dendrites and bursting in layer 5 pyramidal neurons in coincidence detection 180373 (Shai et al., 2015), consequences of inhomogeneous T current distributions for dendritic signaling and localized synaptic integration in LGN interneurons 156039

Network models: control of signal transfer from thalamus to cortex by corticothalamic modulation of resonance in thalamic relay neurons 150240 (Behuret et al. 2013), relative contributions of cellular properties and network architecture to orientation selectivity 182759 (Sadeh and Rotter, 2015), self-organization of cortical color opponent receptive fields 152197 (Eguchi et al., 2014), motion detection by a feedforward network in V1-MT 181035 (Solari et a., 2015)

Hearing

Initial stages of auditory processing: functional model of inner ear microcircuitry 169278 (Zilany et al 2009, 2014; Holmberg M 2007)

Auditory processing in the brainstem: local field potential generation in the medial superior olive 152112 (Goldwyn et al 2014)

Cortical processing: generation of cortical waves in layer 4 of auditory cortex 150678 (Beeman 2013)

Pattern recognition: network models for detecting sliding pitch 168407 (Skorheim et al. 2014)

Electrosensation

Specific cell classes involved in electrosensation: auditory processing in midbrain torus semicircularis neurons 183077 (Aumentado-Armstrong et al. 2015), coding by ELL pyramidal neurons 168590 (Simmonds and Chacron 2014)

Spatial sense

Spatial perception and learning: experienced-induced development grid cells from place cells 150846 (Castro and Aguiar, 2014)

Mechanisms of independent gamma oscillations and grid firing 183017 (Solanka et al 2015)

Theta-nested gamma oscillations (cross-frequency coupling of theta and gamma) in a network model of grid cells 150031 (Pastoll et al., 2013)

Pain

Excitability of dorsal reticular nucleus neurons: 151949 (Sousa et al., 2014)

Motor system

Motor cortex

Structural and functional architecture: microcircuit simulation based on brain activity mapping 146949 (Chadderdon et al. 2014)

Sensorimotor integration

Reflex behavior: modulation of gill withdrawal reflex in Aplysia by interaction of multiple forms of short term synaptic plasticity 152200 (Zhou et al. 2014), gain adaptation of optokinetic reflex 180823 (Yamazaki et al. 2015), adaptation of the vestibulo-ocular reflex 167875 (Clopath et al. 2014)

Saccades: cells and circuitry in the intermediate superior colliculus underlying saccade generation 168866 (Moren et. al. 2013)

Control of a robot: adaptive control by a cerebellar network model: 167414 (Casellato et al. 2014)

Posture and locomotion: crayfish 150697 (Chung et al. 2014) and 150698 (Bacque-Cazenave et al. 2014), modulation of reticulospinal neurons involved in lamprey swimming 151338 (Kozlov et al. 2014), human upright stance 180372 (Elias et al 2014)

Brain rhythms

Central pattern generators: coupled oscillators in stomatogastric ganglion 149910 (Gutierrez et al. 2013), mechanisms for robustness in the face of temperature variation 152636 (Caplan JS et al., 2014), molecular network model of circadian clock in suprachiasmatic nucleus neurons 148320 (Kim and Forger 2013), generation of respiratory rhythms 181962 (Toporikova et al 2015)

Cortical oscillations: roles of gap junctions and cellular subthreshold resonance 168599 (Tchumatchenko and Clopath 2014), interactions of cortical rhythms 155705 (Avella OJ et al. 2014), interlaminar interactions and delta-nested theta 150806 (Carracedo et al. 2013)

Functional roles of theta: mechanism of long intracortical delays in entorhinal-hippocampal network 181967 (Cutsuridis and Poirazi 2015), grid cells and theta-nested gamma oscillations 150031 (Pastoll et al., 2013)

Generation and modulation of gamma oscillations: fast spiking interneurons in Ca1 182843 (Ferguson et al. 2013), persistent gamma in neocortical slice 156072 (Tomsett et al. 2014), modulation of gamma by basket cell extrasynaptic inhibition 155601 (Proddutur et al., 2013)

Role of gap junctions: synchronization of interneurons in striatum 156260 (Damodaran et al. 2014)

Specific phenomena other than rhythmic activity

Decision making: interaction of top-down and bottom-up inputs in sensory processing 168867 (Wimmer et al 2015)

Striatal states: state-dependence of calcium fluctuations in striatal medium spiny neurons 150912 (Evans et al. 2013), 151458 spike-timing dependent synaptically elicited calcium fluctuations in dendritic spines during up and down states (Nakano et al. 2013)

Default mode activity: default mode network model 169775 (Matsui et al 2014)

Functional roles of noise: promotion of independent control of gamma oscillations and grid firing 183017 (Solanka et al 2015)

Learning and memory

Reinforcement learning: dopamine-dependent plasticity at corticostriatal synapses 151458 (Nakano et al. 2013), reinforcement learning algorithms 168143 (Nakano et al 2015), determination of direction of learning by temporal pattern of activation 154967 (Kim et al. 2013), dopamine-related mechanisms involved in reinforcement learning 153573 (Morita and Kato, 2014)

Role of the CREB pathway: 151126 (Bianchi et al. 2014)

Working memory: L5 prefrontal cortex microcircuit generation of persistent activity 155057 (Papoutsi et al. 2014, 2013)

Short term memory: mechanisms for efficient unsupervised learning 169983 (Vertechi, Brendel and Machens 2014)

Sensory learning: odor learning 146813 (de Almeida et al. 2013; Devore S, et al. 2014) olfactory memory and learning 155157 (Kaplan and Lansner 2014), learning of cortical color opponent receptive fields 152197 (Eguchi et al., 2014)

Motor learning: cerebellar memory consolidation 180823 (Yamazaki et al. 2015), fast convergence of cerebellar learning 150225 (Luque et al. 2015), adaptive gain control in cerebellum 150067 (Garrido et al., 2013), adaptive control of a robot by a cerebellar network model 167414 (Casellato et al. 2014)

526 181967 Long time windows from theta modulated inhib. in entorhinal–hippo. loop (Cutsuridis and Poirazi 2015)
mechanism of long intracortical delays in entorhinal-hippocampal network
role of theta activity in coordinating spiking in entorhinal-hippocampal network
roles of inhibitory interneurons in memory retrieval
network model

Conditioned fear

2 150288 A 1000 cell network model for Lateral Amygdala (Kim et al. 2013)
network model
learning and memory: conditioned fear
lateral amygdala

PATHOPHYSIOLOGY

Role of autonomic nervous system in hypertension

902 151482 Sympathetic Preganglionic Neurone (Briant et al. 2014)
cell model
pathophysiology: hypertension may result from increased excitability of sympathetic preganglionic neurons
caused by reduced Ia

Retinal degenerative disorders

128 156781 Bursting and oscillations in RD1 Retina driven by AII Amacrine Neuron (Choi et al. 2014)
pathophysiology: mechanism of retinal oscillations in mouse model of retinal degeneration
cell model

Alzheimer's disease

85 147757 Amyloid-beta effects on release probability and integration at CA3-CA1 synapses (Romani et al. 2013)
effects of ABeta on transmitter release and synaptic integration
cell model
pathophysiology: Alzheimer's disease

330 151126 Effects of increasing CREB on storage and recall processes in a CA1 network (Bianchi et al. 2014)
role of the CREB pathway in learning and memory
pathophysiology: Alzheimer's disease
network model

888 153740 Strategy for kinase transport by microtubules to nerve terminals (Koon et al. 2014)
axon model

axonal transport via motor proteins (kinesin) bound to scaffold proteins (microtubules)
pathophysiology: degenerative disorders in which transport of proteins and organelles is impaired,
e.g. Parkinson's disease, Huntington's disease, Alzheimer's disease

341 154096 Electrostimulation to reduce synaptic scaling driven progression of Alzheimers (Rowan et al. 2014)
network model
pathophysiology of Alzheimer's disease
therapy: neuroprosthesis--low intensity electrical stimulation of neocortex--to slow disease progression

Channelopathies

153 148094 CA1 pyramidal neuron: effects of R213Q and R312W Kv7.2 mutations (Miceli et al. 2013)
cell model
active dendrites
channelopathy: potassium channel mutations
pathophysiology: epilepsy

858 167715 Spreading depression model for FHM3 with Nav1.1 mutation (Dahlem et al. 2014)
pathophysiology: familial hemiplegic migraine type 3
channelopathy: mutation of SCN1A which codes for Nav1.1

Epileptogenesis

634 182906 Neural-field model of generalized seizures (Zhao et al., 2015)
pathophysiology: mechanism of epileptogenesis in primary generalized epilepsy (absence)
pathophysiology: thalamocortical epileptogenesis
network model

654 182134 Normal ripples, abnormal ripples, and fast ripples in a hippocampal model (Fink et al. 2015)
mechanisms of high frequency oscillations (HFOs aka ripples) in hippocampus
relationship between normal and pathological ripples
pathophysiology: hippocampal epileptogenesis
network model

813 169023 Single cell model with variable ion concentrations and Na⁺/K⁺ ATPase (Krishnan et al. 2015)
effect of seizure-induced Na and K concentration changes on electrogenic Na/K transport and neuronal dynamics
pathophysiology: epilepsy
cell model

153 148094 CA1 pyramidal neuron: effects of R213Q and R312W Kv7.2 mutations (Miceli et al. 2013)
cell model
active dendrites
channelopathy: potassium channel mutations

pathophysiology: epilepsy

3 168856 A bistable model of Spike-Wave seizure and background activity (Taylor et al. 2014)
network model (dynamical systems model of a network)
therapy: seizure suppression by stimulation

111 152113 Basal ganglia-corticothalamic (BGCT) network (Chen et al., 2014)
"neural mass" model
pathophysiology: epilepsy (absence seizures)
therapy: mechanism of action of deep brain stimulation

8 155565 A cortical sheet mesoscopic model for investigating focal seizure onset dynamics
(Wang et al. 2014)
network model (neural mass model)
pathophysiology: identifies different mechanisms of onset of focal seizures
therapy: for each mechanism there is a corresponding approach that seems most likely to be effective
including anticonvulsants, local resection, counterstimulus to abort the seizure

Effects of seizure-induced alterations of neuronal morphology

290 155568 Dentate gyrus network model (Tejada et al 2014)
effects of status epilepticus induced alterations of neuronal morphology on network operation and
excitability
pathophysiology: epilepsy
network model

Seizure-induced alterations of cortical rhythms

114 155601 Basket cell extrasynaptic inhibition modulates network oscillations (Proddutur et al.,
2013)
network model
effects of extrasynaptic inhibition on gamma activity
pathophysiology: seizure-induced alterations of cortical rhythms

EtOH

78 180789 Alcohol action in a detailed Purkinje neuron model and an efficient simplified model
(Forrest 2015)
pathophysiology: drug effects: alcohol
model simplification
cell model

Parkinson's disease

892 169984 Striatal NN model of MSNs and FSIs investigated effects of dopamine depletion
(Damodaran et al 2015)
pathophysiology: Parkinson's disease
mechanism of synchronization of fast-spiking interneuron and emergence of beta oscillations in
dopamine-depleted striatum

therapy: implications for treatment of PD
network model

238 147366 Composite spiking network/neural field model of Parkinsons (Kerr et al 2013)
network model
pathophysiology: Parkinson's disease

371 148637 Failure of Deep Brain Stimulation in a basal ganglia neuronal network model (Dovzhenok et al. 2013)
network model
nonlinear dynamical model
therapy: mechanisms and efficacy of patterned deep brain stimulation in Parkinson's disease
delayed feedback stimulation may fail to desynchronize activity that is partially synchronous--
may actually make it more synchronous, which would fail to benefit patient and might
aggravate hypokinesia (i.e. make it more difficult for patient to initiate movement)

888 153740 Strategy for kinase transport by microtubules to nerve terminals (Koon et al. 2014)
axon model
axonal transport via motor proteins (kinesin) bound to scaffold proteins (microtubules)
pathophysiology: degenerative disorders in which transport of proteins and organelles is impaired,
e.g. Parkinson's disease, Huntington's disease, Alzheimer's disease

912 156260 Synchronicity of fast-spiking interneurons balances medium-spiny neurons (Damodaran et al. 2014)
network model
effect of gap junctions on synchronization of interneurons
dopamine depletion can cause imbalance between the activity of striatal D1 and D2 MSNs,
and that in turn disturbs activity in the globus pallidus
gap junctions between FSI (fast spiking interneurons) in striatum causes a slight
increase of synchrony in those cells, which in turn restores balance between D1 and D2 MSN
pathophysiology: mechanisms involved in Parkinson's disease

Alteration of neuronal function by cytokines

382 168148 Firing neocortical layer V pyramidal neuron (Reetz et al. 2014; Stadler et al. 2014)
cell model
combined experimental and modeling study
pathophysiology: effects of acute viral infection of the CNS on neural function
mechanism by which type 1 interferons increase the excitability of layer 5-6 pyramidal cells:
activation PKC reduces HCN1 conductance as well as conductance of M-type and BK potassium
channels, and shifts the voltage-dependent gating of persistent sodium current toward more negative
membrane potentials

Effects of ambient electrical fields

167 151731 CA1 pyramidal neurons: effect of external electric field from power lines (Cavarretta et al. 2014)
cell model
biological effects of ambient electrical fields

Mechanical deformation

635 168861 Neurite: electrophysiological-mechanical coupling simulation framework (Garcia-Grajales et al 2015)
model of effects of mechanical deformation on passive and active propagation of electrical signals in neurons
pathophysiology: mechanisms underlying dysfunction induced by brain trauma

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OTHER

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NONNEURAL CELLS AND SYSTEMS

563 150691 Model of arrhythmias in a cardiac cells network (Casalessio et al. 2014)
myocardial network model
conduction abnormality involving gap junctions that results in reentrant arrhythmia
pathophysiology: cardiac arrhythmia

EXPERIMENTAL METHODS AND INTERPRETATION OF EXPERIMENTAL OR SIMULATION RESULTS

Interpretation of neuronal morphometric data

252 146950 Constructed Tessellated Neuronal Geometries (CTNG) (McDougal et al. 2013)
cell model
method: relating "point and diameter format" morphometric data to three dimensional volume occupied by a cell
needed for models that combine electrical signaling with intracellular reactive diffusion

Estimating sum of weighted synaptic inputs

852 154732 Spine head calcium in a CA1 pyramidal cell model (Graham et al. 2014)
interpretation of experimental results (a methods paper): spine head calcium
as a proxy for sum of weighted synaptic inputs

Compensation for space clamp errors

312 152028 Drosophila 3rd instar larval aCC motoneuron (Gunay et al. 2015)
excitability of invertebrate neurons
compensation for space clamp errors
structure-function relationship in invertebrate neurons
cell model

Optimization

483 151825 Ionic mechanisms of dendritic spikes (Almog and Korngreen 2014)

cell model
active dendrites
combined experimentation and modeling
optimization method for empirically-based modeling: "parameter peeling"

826 156162 Software (called Optimizer) for fitting neuronal models (Friedrich et al. 2014)
methods: optimization

Determination of PRC

704 155735 Phase response curves firing rate dependency of rat purkinje neurons in vitro (Couto et al 2015)
experimental and computational determination of cellular phase response curves
cell model

Time series analysis

90 154927 Analyzing neural time series data theory and practice (Cohen 2014)
methods for analyzing time series data

Electrical stimulation, including DBS

332 168414 Effects of spinal cord stimulation on WDR dorsal horn network (Zhang et al 2014)
network model
mechanisms of spinal cord stimulation
therapy: neuroprosthesis--spinal cord stimulation for relief of chronic neuropathic pain

341 154096 Electrostimulation to reduce synaptic scaling driven progression of Alzheimers (Rowan et al. 2014)
network model
pathophysiology of Alzheimer's disease
therapy: neuroprosthesis--low intensity electrical stimulation of neocortex--to slow disease progression

301 147460 Direct recruitment of S1 pyramidal cells and interneurons via ICMS (Overstreet et al., 2013)
ICMS = intracranial microstimulation
method: stimulation of neurons in the brain
therapeutic implications: sensory prosthesis
axon model

371 148637 Failure of Deep Brain Stimulation in a basal ganglia neuronal network model (Dovzhenok et al. 2013)
network model
nonlinear dynamical model
therapy: mechanisms and efficacy of patterned deep brain stimulation in Parkinson's disease
delayed feedback stimulation may fail to desynchronize activity that is partially synchronous--
may actually make it more synchronous, which would fail to benefit patient and might
aggravate hypokinesia (i.e. make it more difficult for patient to initiate movement)

111 152113 Basal ganglia-corticothalamic (BGCT) network (Chen et al., 2014)
"neural mass" model
pathophysiology: epilepsy (absence seizures)
therapy: mechanism of action of deep brain stimulator

167 151731 CA1 pyramidal neurons: effect of external electric field from power lines (Cavarretta et al. 2014)
cell model
biological effects of ambient electrical fields

Quantification of network architectures

869 151692 Statistics of symmetry measure for networks of neurons (Esposito et al. 2014)
method: quantification of network architecture

SIMULATION METHODS

MAPK cascade

17 146024 A generic MAPK cascade model for random parameter sampling analysis (Mai and Liu 2013)
molecular network

Simulation of reaction-diffusion mechanisms

733 153351 Python-based toolkits for STEPS (Chen and De Schutter 2014)
methods: simulator for stochastic reaction-diffusion simulation
mechanisms of intracellular chemical signaling

NMDAergic synaptic transmission

13 145836 A fast model of voltage-dependent NMDA Receptors (Moradi et al. 2013)
models of NMDAergic synaptic transmission

Stochastic channel modeling

21 150207 A Method for Prediction of Receptor Activation in the Simulation of Synapses (Montes et al. 2013)
synapse model
efficient method for approximating results of Monte Carlo simulations of ligand-gated channels

229 167772 Comparison of DA-based Stochastic Algorithms (Pezo et al. 2014)
numerical methods
stochastic channel gating

Channelrhodopsin gating model

241 150804 Computational modelling of channelrhodopsin-2 photocurrent characteristics (Stefanescu

et al. 2013)
cell model
model of channelrhodopsin 2 gating by photostimulation

Simplified models of neurons and networks

140 182515 CA1 pyramidal neuron (Ferguson et al. 2014)
empirically based simplified model for use in large scale network models
cell model

390 155856 Fractional leaky integrate-and-fire model (Teka et al. 2014)
cell model
simplified models
overreaching claims--what do these authors know about real cells?

554 144993 Method for deriving general HH neuron model's spiking input-output relation (Soudry and Meir 2014)
cell model
method: for deriving input-output relationship of HH-style models.

628 155130 Neural mass model based on single cell dynamics to model pathophysiology (Zandt et al 2014)
network model
strategy for simplifying large scale models in order to reflect the effects of channelopathy, channel blockers, and ionic concentration shifts on network function

Synthesis of model neurons and networks

619 182135 NETMORPH: creates NNs with realistic neuron morphologies (Koene et al. 2009, van Ooyen et al. 2014)
cell model
network model
method for synthesizing empirically based neuronal morphologies and network architectures whose cellular elements have these morphologies

1 151681 3D model of the olfactory bulb (Migliore et al. 2014)
network model
dendritic excitability
reciprocal synapses
sensory processing: olfaction
synthetic neuronal morphologies
development of network architecture through Hebbian synaptic plasticity

409 167638 Generation of granule cell dendritic morphology (Schneider et al. 2014)
empirically-based synthesis of neuronal morphologies

Functional model of cochlea

223 169278 Cochlea: inner ear models in Python (Zilany et al 2009, 2014; Holmberg M 2007)

empirically based microcircuit model (hair cell -> auditory axon)

sensory processing: hearing

useful for studies in which it is necessary to transform an auditory signal to auditory nerve spiking,

to test hypotheses about neural encoding,

and in clinical studies of auditory processing and perception in patients with hearing loss

Effects of neuronal deformation

635 168861 Neurite: electrophysiological-mechanical coupling simulation framework

(Garcia-Grajales et al 2015)

model of effects of mechanical deformation on passive and active propagation of electrical signals in neurons

pathophysiology: mechanisms underlying dysfunction induced by brain trauma

Multiple unit recordings

9 147487 A detailed and fast model of extracellular recordings (Camunas-Mesa and Qurioga 2013)

network model

simulation of multiple unit recordings (spikes, as distinct from local field potentials

which are generated by synaptic currents)

Field potentials

118 147172 Biophysical model for field potentials of networks of IandF neurons (beim Graben and Serafim 2013)

network model

method for using simulations generated by vastly simplified neuronal models to calculate approximate local field potentials

29 152112 A model of local field potentials generated by medial superior olive neurons (Goldwyn et al 2014)

local field potentials

sensory processing: hearing

cell model in an extracellular conductive medium

506 156072 Large-scale model of neocortical slice in vitro exhibiting persistent gamma (Tomsett et al. 2014)

network model

cortical oscillations

simulation method: simulation of LFPs

Spiking network simulators

655 154739 Norns - Neural Network Studio (Visser and Van Gils 2014)

methods

software for constructing and simulating spiking network models