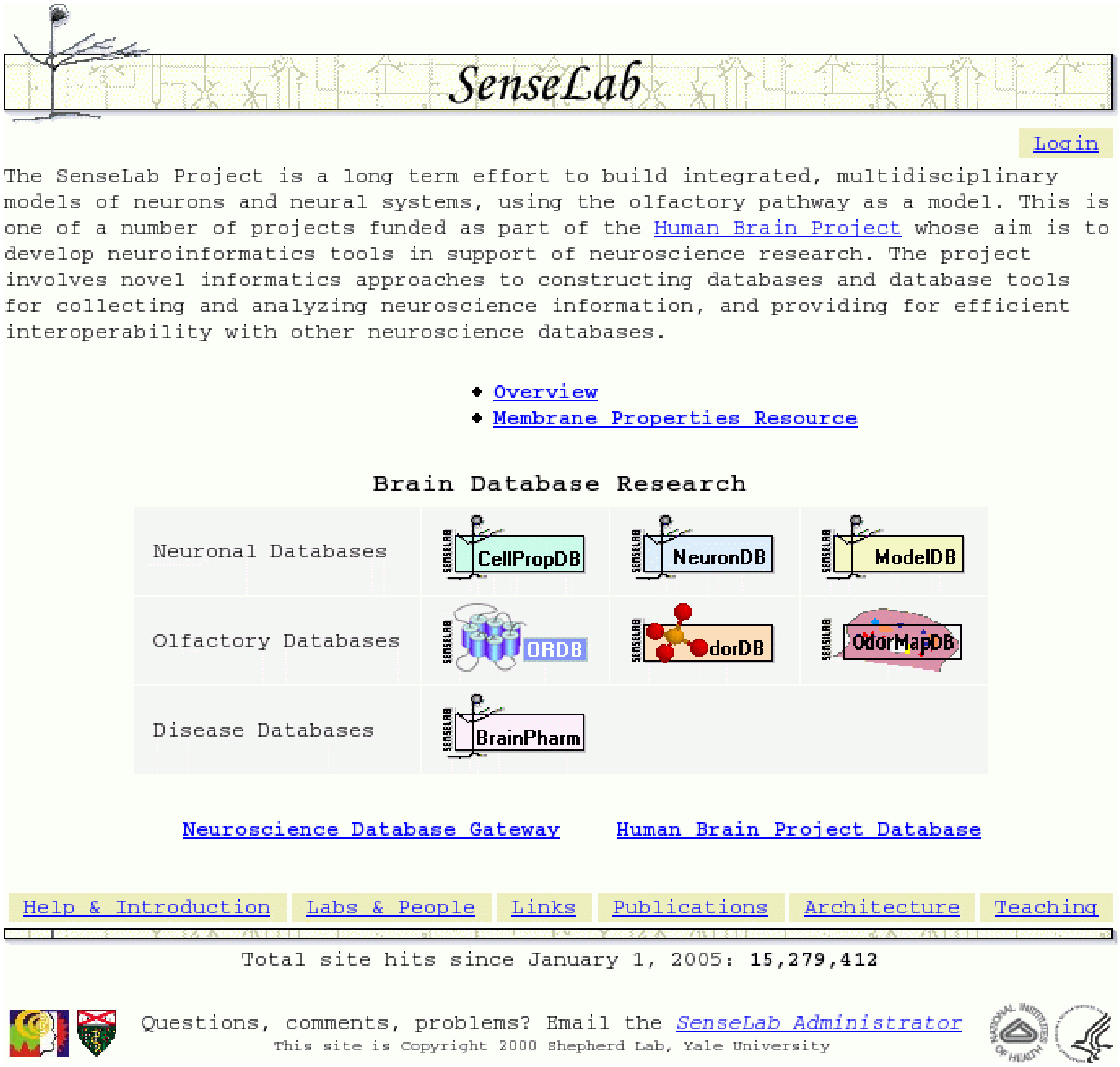
SenseLab
Log in
The SenseLab Project is a long term effort to build integrated, multidisciplinary models of neurons and neural systems, using the olfactory pathway as a model. This is one of a number of projects funded as part of the Human Brain Project whose aim is to develop neuroinformatics tools in support of neuroscience research. The project involves novel informatics approaches to constructing databases and database tools for collecting and analyzing neuroscience information, and providing for efficient interoperability with other neuroscience databases.
Overview
Membrane Properties Resource
Brain Database Research
Neuronal Databases
CellPropDB
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ModelDB
Olfactory Databases
ORDB
OdorDB
OdorMapDB
Disease Databases
BrainPharm
Neuroscience Database Gateway
Human Brain Project Database
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Total site hits since January 1, 2005: 15,279,412
Questions, comments, problems? Email the SenseLab Administrator
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NeuronDB

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NeuronDB provides a dynamically searchable database of three types of neuronal properties: voltage gated conductances, neurotransmitter receptors, and neurotransmitter substances. It contains tools that provide for integration of these properties in a given type of neuron and compartment, and for comparison of properties across different types of neurons and compartments. Read the tutorial for searching for Neuron Properties in NeuronDB

This resource is intended to:

- Support the genomics and proteomics of neuron types
- Support research on neuron properties
- Facilitate the creation of computational neuronal models
- Identify receptors across neuron types to aid in drug development
- Serve as a teaching aid

Search the Database By:

- Neuron List Alphabetically
- Neuron List By Brain Regions
- Membrane Properties Comprehensive Inventory: Channels, Receptors, Neurotransmitters/Neuromodulators
- Membrane Properties for NeuronDB: Currents, Receptors, Neurotransmitters/Neuromodulators
- Canonical forms of neurons (see explanation)
- Bibliographic citations

- Signup to receive the NeuronDB email newsletter
- Give us your feedback
- Deposit to the Database
- FAQ and related Links
- NeuronDB Login

This database is being developed by Luis N. Marenco[2], Chiquito Crasto[2], Prakash M. Nadkarni[2], Perry L. Miller[2] and Gordon M. Shepherd[1], [1]*Section of Neurobiology*, [2]*Center for Medical Informatics, Yale University School of Medicine, New Haven, CT 06510.*

Some of the data, together with the graphics on the NeuronDB banner, are taken from The Synaptic Organization of the Brain, edited by G.M. Shepherd, New York: Oxford University Press (Second to Fourth Editions: 1979, 1990, 1998).

Supported by NIDCD, NASA, & NIMH (Human Brain Project) and the National Library of Medicine's IAIMS Program.

Total site hits since January 1, 2005: **405,411**

NeuronDB

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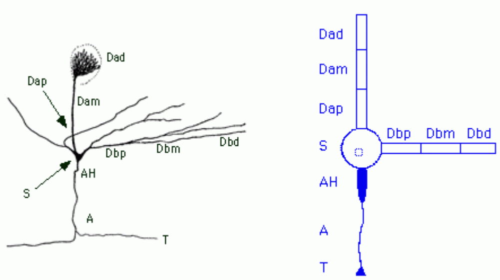
Olfactory bulb mitral cell

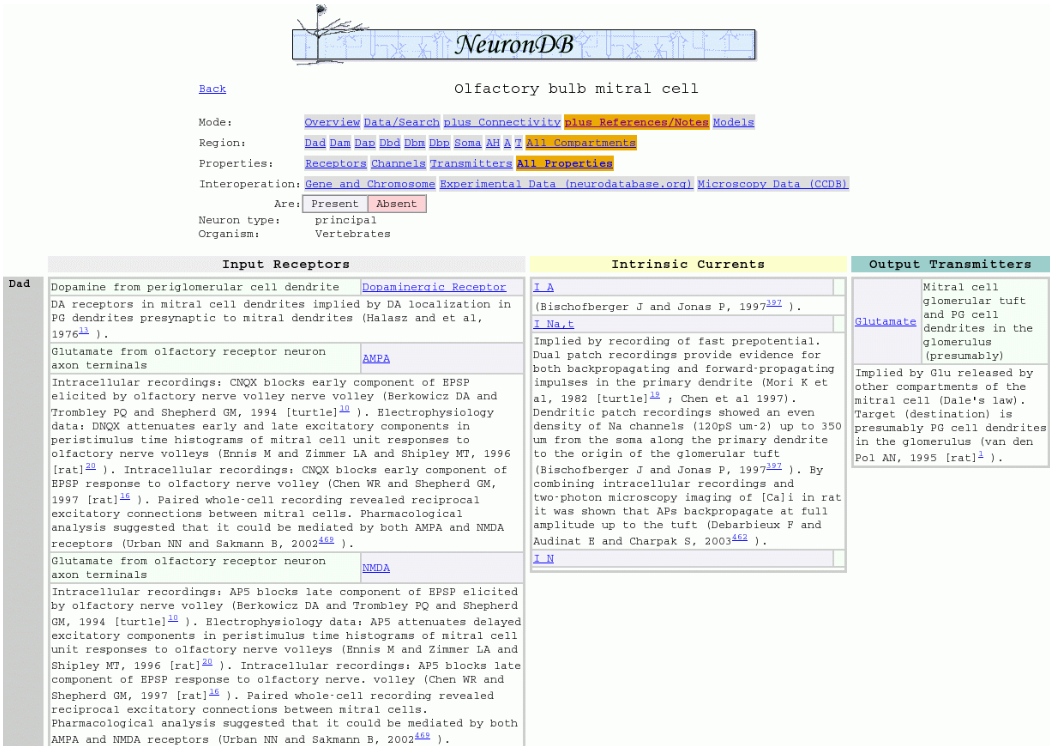
Mode:	**Overview** Data/Search plus Connectivity plus References/Notes Models
Region:	Dad Dam Dap Dbd Dbm Dbp Soma AH A T All Compartments
Properties:	Receptors Channels Transmitters **All Properties**
Interoperation:	Gene and Chromosome Experimental Data (neurodatabase.org) Microscopy Data (CCDB)
Neuron type:	principal
Organism:	Vertebrates



Key: Region: D, dendrite; S, soma (cell body); AH, axon hillock-initial segment of the axon; A, axon; T, axon terminal. Type of dendrite: e, equivalent cylinder (for single dendrites and multipolar trees); a, apical; b, basal; o, oblique. Level of dendrite: (p) proximal, (m) middle, and (d) distal with respect to the cell body. For further explanations, see canonical representations.

Graphic from: GM Shepherd, Synaptic Organization of the Brain, New York: Oxford University Press 1979.

Total site hits since January 1, 2005: **405,417**



NeuronDB

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Olfactory bulb mitral cell

Mode: Overview Data/Search plus Connectivity plus References/Notes Models

Region: Dad Dam Dap Dbd Dbm Dbp Soma AH A T All Compartments

Properties: Receptors Channels Transmitters All Properties

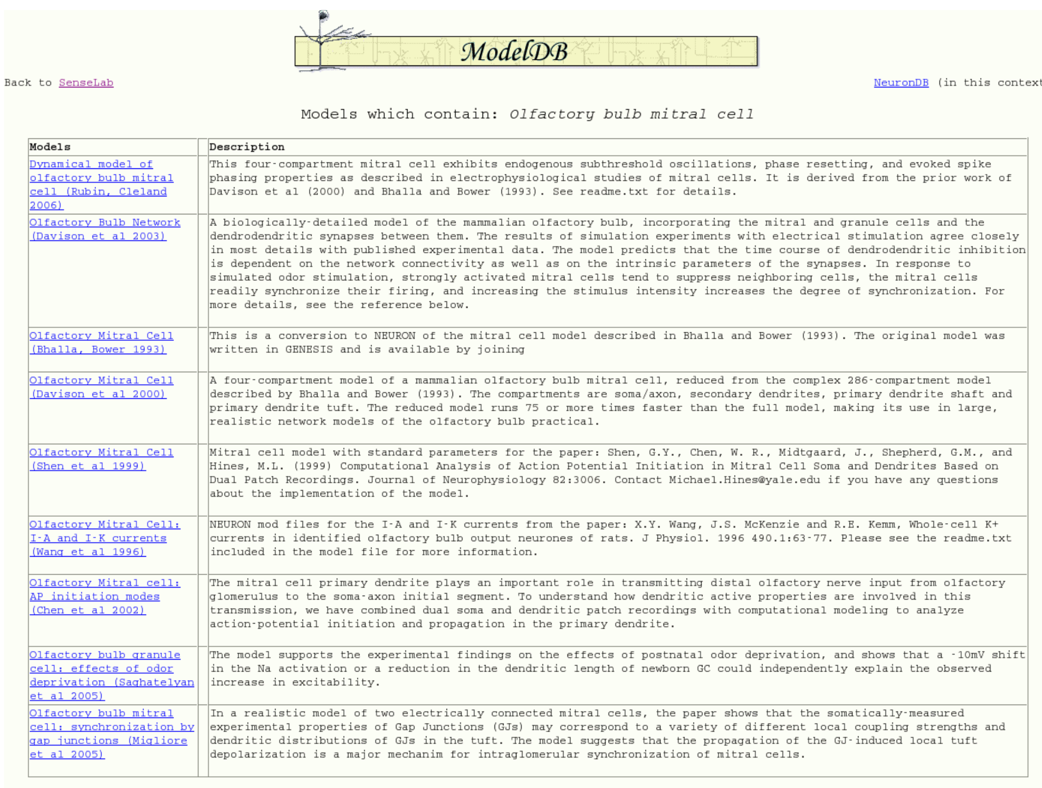
Interoperation: Gene and Chromosome Experimental Data (neurodatabase.org) Microscopy Data (CCDB)

Are: Present Absent

Neuron type: principal

Organism: Vertebrates

	Input Receptors		Intrinsic Currents	Output Transmitters	
Dad	Dopamine from periglomerular cell dendrite	Dopaminergic Receptor	I A	Glutamate	Mitral cell glomerular tuft and PG cell dendrites in the glomerulus (presumably)
	DA receptors in mitral cell dendrites implied by DA localization in PG dendrites presynaptic to mitral dendrites (Halasz and et al, 1976[13]).		(Bischofberger J and Jonas P, 1997[397]).	Implied by Glu released by other compartments of the mitral cell (Dale's law). Target (destination) is presumably PG cell dendrites in the glomerulus (van den Pol AN, 1995 [rat][1]).	
	Glutamate from olfactory receptor neuron axon terminals	AMPA	I Na,t		
	Intracellular recordings: CNQX blocks early component of EPSP elicited by olfactory nerve volley nerve volley (Berkowicz DA and Trombley PQ and Shepherd GM, 1994 [turtle][10]). Electrophysiology data: DNQX attenuates early and late excitatory components in peristimulus time histograms of mitral cell unit responses to olfactory nerve volleys (Ennis M and Zimmer LA and Shipley MT, 1996 [rat][20]). Intracellular recordings: CNQX blocks early component of EPSP response to olfactory nerve volley (Chen WR and Shepherd GM, 1997 [rat][16]). Paired whole-cell recording revealed reciprocal excitatory connections between mitral cells. Pharmacological analysis suggested that it could be mediated by both AMPA and NMDA receptors (Urban NN and Sakmann B, 2002[469]).		Implied by recording of fast prepotential. Dual patch recordings provide evidence for both backpropagating and forward-propagating impulses in the primary dendrite (Mori K et al, 1982 [turtle][19] ; Chen et al 1997). Dendritic patch recordings showed an even density of Na channels (120pS um-2) up to 350 um from the soma along the primary dendrite to the origin of the glomerular tuft (Bischofberger J and Jonas P, 1997[397]). By combining intracellular recordings and two-photon microscopy imaging of [Ca]i in rat it was shown that APs backpropagate at full amplitude up to the tuft (Debarbieux F and Audinat E and Charpak S, 2003[462]).		
	Glutamate from olfactory receptor neuron axon terminals	NMDA	I N		
	Intracellular recordings: AP5 blocks late component of EPSP elicited by olfactory nerve volley (Berkowicz DA and Trombley PQ and Shepherd GM, 1994 [turtle][10]). Electrophysiology data: AP5 attenuates delayed excitatory components in peristimulus time histograms of mitral cell unit responses to olfactory nerve volleys (Ennis M and Zimmer LA and Shipley MT, 1996 [rat][20]). Intracellular recordings: AP5 blocks late component of EPSP response to olfactory nerve. volley (Chen WR and Shepherd GM, 1997 [rat][16]). Paired whole-cell recording revealed reciprocal excitatory connections between mitral cells. Pharmacological analysis suggested that it could be mediated by both AMPA and NMDA receptors (Urban NN and Sakmann B, 2002[469]).				



ModelDB

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NeuronDB (in this context)

Models which contain: *Olfactory bulb mitral cell*

Models	Description
Dynamical model of olfactory bulb mitral cell (Rubin, Cleland 2006)	This four-compartment mitral cell exhibits endogenous subthreshold oscillations, phase resetting, and evoked spike phasing properties as described in electrophysiological studies of mitral cells. It is derived from the prior work of Davison et al (2000) and Bhalla and Bower (1993). See readme.txt for details.
Olfactory Bulb Network (Davison et al 2003)	A biologically-detailed model of the mammalian olfactory bulb, incorporating the mitral and granule cells and the dendrodendritic synapses between them. The results of simulation experiments with electrical stimulation agree closely in most details with published experimental data. The model predicts that the time course of dendrodendritic inhibition is dependent on the network connectivity as well as on the intrinsic parameters of the synapses. In response to simulated odor stimulation, strongly activated mitral cells tend to suppress neighboring cells, the mitral cells readily synchronize their firing, and increasing the stimulus intensity increases the degree of synchronization. For more details, see the reference below.
Olfactory Mitral Cell (Bhalla, Bower 1993)	This is a conversion to NEURON of the mitral cell model described in Bhalla and Bower (1993). The original model was written in GENESIS and is available by joining
Olfactory Mitral Cell (Davison et al 2000)	A four-compartment model of a mammalian olfactory bulb mitral cell, reduced from the complex 286-compartment model described by Bhalla and Bower (1993). The compartments are soma/axon, secondary dendrites, primary dendrite shaft and primary dendrite tuft. The reduced model runs 75 or more times faster than the full model, making its use in large, realistic network models of the olfactory bulb practical.
Olfactory Mitral Cell (Shen et al 1999)	Mitral cell model with standard parameters for the paper: Shen, G.Y., Chen, W. R., Midtgaard, J., Shepherd, G.M., and Hines, M.L. (1999) Computational Analysis of Action Potential Initiation in Mitral Cell Soma and Dendrites Based on Dual Patch Recordings. Journal of Neurophysiology 82:3006. Contact Michael.Hines@yale.edu if you have any questions about the implementation of the model.
Olfactory Mitral Cell: I-A and I-K currents (Wang et al 1996)	NEURON mod files for the I-A and I-K currents from the paper: X.Y. Wang, J.S. McKenzie and R.E. Kemm, Whole-cell K+ currents in identified olfactory bulb output neurones of rats. J Physiol. 1996 490.1:63-77. Please see the readme.txt included in the model file for more information.
Olfactory Mitral cell: AP initiation modes (Chen et al 2002)	The mitral cell primary dendrite plays an important role in transmitting distal olfactory nerve input from olfactory glomerulus to the soma-axon initial segment. To understand how dendritic active properties are involved in this transmission, we have combined dual soma and dendritic patch recordings with computational modeling to analyze action-potential initiation and propagation in the primary dendrite.
Olfactory bulb granule cell: effects of odor deprivation (Saghatelyan et al 2005)	The model supports the experimental findings on the effects of postnatal odor deprivation, and shows that a -10mV shift in the Na activation or a reduction in the dendritic length of newborn GC could independently explain the observed increase in excitability.
Olfactory bulb mitral cell: synchronization by gap junctions (Migliore et al 2005)	In a realistic model of two electrically connected mitral cells, the paper shows that the somatically-measured experimental properties of Gap Junctions (GJs) may correspond to a variety of different local coupling strengths and dendritic distributions of GJs in the tuft. The model suggests that the propagation of the GJ-induced local tuft depolarization is a major mechanim for intraglomerular synchronization of mitral cells.

Total site hits since January 1, 2005: **854,312**

A single column thalamocortical network model (Traub et al 2004)

To better understand population phenomena in thalamocortical neuronal ensembles, we have constructed a preliminary network model with 3,560 multicompartment neurons (containing soma, branching dendrites, and a portion of axon). Types of neurons included superficial pyramids (with regular spiking [RS] and fast rhythmic bursting [FRB] firing behaviors); RS spiny stellates; fast spiking (FS) interneurons, with basket-type and axoaxonic types of connectivity, and located in superficial and deep cortical layers; low threshold spiking (LTS) interneurons, that contacted principal cell dendrites; deep pyramids, that could have RS or intrinsic bursting (IB) firing behaviors, and endowed either with non-tufted apical dendrites or with long tufted apical dendrites; thalamocortical relay (TCR) cells; and nucleus reticularis (nRT) cells. To the extent possible, both electrophysiology and synaptic connectivity were based on published data, although many arbitrary choices were necessary.

References:

1. Traub RD, Contreras D, Cunningham MO, Murray H, Lebeau FE, Roopun A, Bibbig A, et al (2005) A single-column thalamocortical network model exhibiting gamma oscillations, sleep spindles and epileptogenic bursts. *J Neurophysiol* **93(4)**:2194-232 [PubMed]
2. Traub RD, Contreras D, Whittington MA (2005) Combined experimental-simulation studies of cellular and network mechanisms of epileptogenesis in vitro and in vivo. *J Clin Neurophysiol* **22**:330-42 [PubMed]

Citations Citation Browser

Model Information *(Click on a link to find other models with that property)*

Model Type:	Network;
Cell Type(s):	Thalamic relay neuron; Thalamic reticular neuron; Neocortical pyramidal neuron: deep; Neocortical pyramidal neuron: superficial;
Channel(s):	I Na,p; I Na,t; I L high threshold; I T low threshold; I A; I K; I M; I IR,Q,h; I K,Ca; I Calcium; I A, slow;
Receptor(s):	GabaA; AMPA; NMDA;
Transmitter(s):	
Simulation Environment:	Neuron; FORTRAN;
Model Concept(s):	Activity Patterns; Bursting; Temporal Pattern Generation; Oscillations; Simplified Models;
Implementer(s):	Traub, Roger D;

Search NeuronDB for information about: Neocortical pyramidal neuron: deep; Neocortical pyramidal neuron: superficial; Thalamic relay neuron; Thalamic reticular neuron; AMPA; GabaA; NMDA; I A; I A, slow; I Calcium; I IR,Q,h; I K; I K,Ca; I L high threshold; I M; I Na,p; I Na,t; I T low threshold;