Introduction

In the effort to construct and simulate biophysically realistic neuronal models, collating and organizing experimental data from the literature (i.e. morphological features, channel densities, connectivity) for implementation, as well as data for tuning the constructed model (input resistance, spiking patterns etc.), is a time−consuming task. Often the detailed description of a particular neuronal feature is not available for the cell in question, and it is necessary to modify the required information from a "closest possible match". To facilitate this effort, we have constructed the relational database *CoCoDat* (*Co*llection of *Co*rtical *Dat*a) (Dyhrfjeld−Johnsen et al. 2001), which contains experimental data on the single neuron and microcircuit level. Data is collated from the published scientific literature, and is comprised of detailed bibliographical and methodological data linked to experimental findings in the categories *Morphology, Firing Properties, Ionic Currents, Ionic Conductances, Synaptic Currents* and *Connectivity*.

Mapping of data

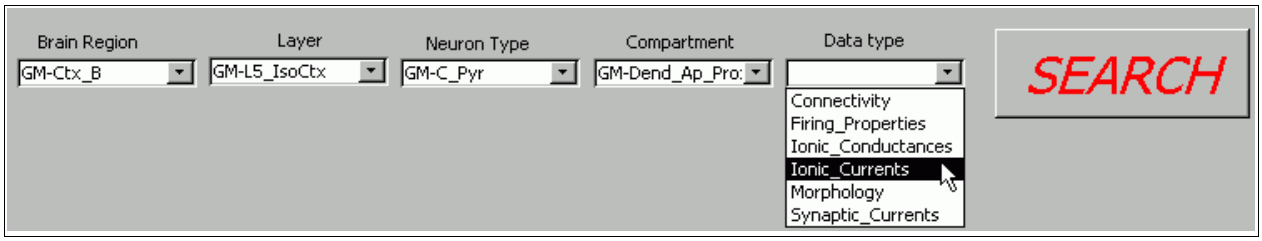
In order to ensure a reliable mapping of the experimental data to the correct recording site, we use *Brainsite* designators, describing the anatomical position of the recording at the levels of *Brain Region*, *Layer*, *Neuron Type* and *Subcellular Compartment*. These brainsites are not strictly delineated like the detailed brainmap information in e.g. CoCoMac (www.cocomac.org), but rely on the descriptive terms commonly used in electrophysiological literature. The full description of a recording site consist of 4 such brainsites, one on each level of description. In our mapping scheme, a recording from the proximal apical dendrite of a layer 5 pyramidal neuron in the barrel cortex would be entered into the database as

Brain Region	Layer	Neuron Type	Compartment
GM−Ctx_B	*GM−L5_IsoCtx*	*GM−C_Pyr*	*GM−Dend_Ap_Prox*

The abbreviation "GM" refers to the brainsites being organized in a (non−delineated) General Map adopted from CoCoMac (Stephan et al. 2001). The hierarchical relationship of the entered brainsites is defined using a set *Brainsite Hierarchical Codes*, defining a series of Parent/Child relationships on each level of description (e.g. Sensorimotor cortex is the parent of Somatosensory cortex, which again is the parent of Barrel cortex).

Data extraction and representation

The database user can invoke powerful search functions based on our mapping scheme to extract a very specific or broader defined subset of data from CoCoDat. If the desired data for a specific structure is not available, one can search for data from a closely related structure. The search is invoked by the user selecting a brainsite on each level of description as well as one of the 6 data categories:



Initially, the search−routine checks whether the recording site exists in the database, and subsequently whether any experimental data in the desired category has been entered. One can also choose to relax the constraints of the query, and e.g. select the compartment description *apical dendrite* instead of only the proximal part. In this case, an all−to−all combination of the

first 3 brainsites (Region, Layer and Neuron Type) with the the 4th (GM−Dend_Ap) *and* all existing children, as defined by the brainsite hierarchical codes, are searched. In this example the result is a total of 5 recording sites (combinations with *apical, proximal apical, medial apical, distal apical* and *apical oblique dendrite*), as none of the first 3 brainsites have any child−structures.

This allows the user to extract data from CoCoDat in a a flexible manner, either information on very specific structure, or on a broader group of structures useable e.g. for comparisons, or in case information is not available for the particular structure one wants to model. In all instances a direct link from the experimental findings to the methodological information is provided.

To further facilitate the selection of the optimal data for modelling, we have implemented a graphical hierarchical representation of the search results. The recording site can be seen as a vector with 4 parameters (the 4 brainsite designators). A branching tree structure based on 1 of the 4 parameters can be displayed at a time, showing the anatomical relationship of the search results. This will greatly facilitate the selection of results from the closest possible match to the modelled object.

We will illustrate the usefulness of the CoCoDat database, and the built−in tools to facilitate modelling, in the implementation of a detailed single cell model of a layer 5 pyramidal cell from the barrel cortex of the rat.

References:

Dyhrfjeld−Johnsen, J, Stephan, KE, Kamper, L, Luhmann, HJ, Kötter, R (2001) CoCoDat: a database of microcircuitry data for large−scale modelling of cortical networks. *NeuroImage* 13(6): S112.

Stephan KE, Kamper L, Bozkurt A, Burns GAPC, Young MP, Kötter R (2001) Advanced database methodology for the collation of connectivity data on the macaque brain (CoCoMac). *Phil. Trans. R. Soc. Lond. B* 356: 1159−1186.