

# NeuroNames in XML & Excel

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**BrainInfo**



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NeuroNames is a digital codification of neuroanatomical nomenclature (names) and ontology (definitions and relations) designed for use by neuroinformaticists. The nomenclature, which is presented here, enables those engaged in database management and website development to resolve ambiguities of neuroanatomical nomenclature that handicap the use of databases by scientists with limited knowledge of neuroanatomy and that prevent interoperability between databases indexed in different terminologies.

The XML and Excel versions of the NeuroNames nomenclature provide a standard terminology, list of synonyms and URLs to definitions and other information for the most comprehensive set of neuroanatomical structures currently available to the information technology community. The NeuroNames nomenclature and ontology continue to evolve toward the ideal of codifying all names and all definitions of neuroanatomical structures found in neuroscientific publications. It includes a standard vocabulary of structure names selected by criteria designed to maximize practicality for use in verbal communication as well as computerized knowledge management, and it contains synonyms of the standard terms in several languages.

Now more than twenty years in development, NeuroNames relates more than 16,000 names in eight languages to some 2,500 neuroanatomical concepts. Designed originally to allow the BrainInfo/NeuroMaps website to interpret users' queries and to clarify the terminology of remote web pages ([Bowden et al., 2011](#)), it has become a resource vocabulary of the National Library of Medicine's Unified Medical Language System ([UMLS-2011](#)) and the basis for the brain regions component of NIFSTD ([NeuroLex-2011](#)). Previous versions of NeuroNames have been downloaded to hundreds of laboratories for indexing data and for linking to BrainInfo. BrainInfo attracts an average of 480 visitors/day, who download 2,000 pages/day.

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The number of structure names and concepts in NeuroNames continues to grow. Updated versions are currently posted in two formats: as an XML schema, which is updated monthly, and as worksheet tables in Microsoft Excel, which are updated biannually. Informaticists who fail to find the names of neuroanatomical structures of interest are encouraged to submit them for inclusion in NeuroNames by contacting the curator of BrainInfo:

dmbowden@u.washington.edu.

# NeuroNames Nomenclature in XML

XML Tag Excel Header	Definition
<p style="text-align: center;">XML tag <b>concept brainInfoID</b></p> <p style="text-align: center;">Excel column head <b>ID</b></p>	<p>A unique and permanent <b>numeric identifier</b> assigned to each neuro-anatomical structure. The structural concept identified is the text definition of the structure in the NeuroNames ontology, which resides at the web address tagged 'biCentralDirectory' (see below).</p> <p>This version of NeuroNames includes concepts of central nervous system structures from the level of brain and spinal cord down to the lowest level of primary structures, i.e., cortical areas, nuclei, tracts and fasciculi. It does not include comprehensive listings of the layers of cortex in individual architectonic areas or subnuclei of all nuclei.</p>
<p style="text-align: center;">XML tag <b>cNIDType and cNID</b></p> <p style="text-align: center;">Excel: column head <b>Old Concept Type &amp; Old NN ID</b></p>	<p>The <b>cNIDType and cNID tags</b> will be useful only to users of NeuroNames versions earlier than 2009. In the first digital version of NeuroNames issued in 1999, each structure was classified as 'h' or 'a' depending on whether it was an item in the classical hierarchy of brain structures (h) or not (a for ancillary). In addition it was assigned a random numeric ID. The combination was used by many individuals to bookmark pages in BrainInfo and by many websites for interoperability with BrainInfo.</p> <p>Reorganization of BrainInfo in 2009 involved replacement of the dual alphanumeric system with a single numeric ID for each structure, the concept brainInfoID described above. One can still interact with BrainInfo using the old IDs. But, some 500 concepts and several thousand structure names have been added to NeuroNames since the conversion. So new users are advised to use the permanent 'concept brainInfoIDs' for indexing, bookmarking and interoperability. The old IDs are included here to allow earlier users of pre-2009 NeuroNames to match concepts with the new IDs.</p>
<p style="text-align: center;">XML tag <b>standardName</b></p> <p style="text-align: center;">Excel column head <b>Name</b></p>	<p>A single <b>standard name</b> for every structure allows NeuroNames to be used as a controlled vocabulary for indexing and interoperability of databases. The standard names are used in BrainInfo to assure consistent, unambiguous definition of neuroanatomical structures and their relations to one another. Two absolute criteria for selecting a standard name are that it be English and that it be unique, i.e., apply to one and only one structure. Other considerations in selecting a standard name from among synonyms are mnemonic value, use frequency, brevity, ease of spelling, ease of pronunciation, and consistency of format with the names of other structures in the same category. Very occasionally the standard name of a structure is changed when we come across a synonym that better fits the criteria. Thus, the standard name is not a reliable substitute for the numeric ID (concept brainInfoID) for indexing a database.</p>

XML Tag Excel Header	Definition
XML tag <b>standardAcronym</b>  Excel column head <b>Acronym</b>	<p>A <b>standard acronym</b> for each structure allows NeuroNames to provide a controlled label set for illustrations, graphs and tables. Many but not all structures have a standard acronym, which is used to maintain consistency for those purposes in BrainInfo.</p> <p>The only absolute criterion in selecting a standard acronym is that it be unique. Other important considerations are brevity, mnemonic value, and usage in the most widely used brain atlases. As with the standard name, a standard acronym is very occasionally changed. Thus, the standard acronym is also not a reliable substitute for the numeric ID (concept brainInfoID) for indexing a neuroanatomical database.</p>
XML tag <b>synonym</b>  Excel column head (Synonyms table) <b>Name</b>	<p>The best known neuroanatomical structures have an average of six English and Latin <b>synonyms</b> in common use. All of the names and acronyms for a given structure are its synonyms. The standard name is selected from among its English synonyms.</p> <p>The inclusion of all names for a structure in NeuroNames allows the manager of a database or knowledge resource to have it respond to queries that use any of the structure’s synonyms. Key features of a synonym are its language (synonymLanguage) and its use frequency in the published literature (pubMedHits)</p>
XML tag <b>synonymLanguage</b>  Excel column head <b>Language</b>	<p>NeuroNames includes the names of neuroanatomical structures in several languages. Currently it includes <b>synonyms in eight languages</b>: English, Latin, French, German, Indonesian, Italian, Russian and Spanish. Acronyms are treated as a ‘ninth language’. Names are case sensitive and represented in Unicode for the alphabet of the language.</p>
XML tag <b>pubMedHits</b>  Excel column head N/A	<p>A major criterion in the selection of a standard name from among synonyms is its <b>use frequency</b>. The metric for use frequency in NeuroNames is the number of PubMed abstracts of the past twenty five years in which the name appeared.</p>
XML tag <b>brainInfoURL</b>  Excel column head <b>BrainInfo URL</b>	<p><b>The URL of the central directory page in BrainInfo</b> is used for interoperability between a neuroscientific database or website and BrainInfo. It links users of other resources, who wish to know more about a structure mentioned there, to the webpage in BrainInfo that provides such information. The Central Directory provides the text definition of the structure, illustrations, connections, kinds of cells found there, and species that have or do not have the structure.</p>