

Security

Various new security measures have been introduced in LOVD 2.0, protecting the sensitive patient data. LOVD 2.0 implements techniques to prevent brute force attacks, SQL injection and XSS attacks. When desired, access of authorized users can be limited to specific IP addresses making access to LOVD, even with the right password, impossible from other computers or from outside your institution.

Brute force attacks are prevented by locking submitter, curator and manager accounts after three failed login attempts. In addition LOVD 2.0 has a system log allowing the tracking of attempts to break security by authorized as well as external users.

To protect the data consistency in the MySQL database, the InnoDB table type has been chosen to be the default table type.

Did you know:

- The single largest known LOVD installation contains 12,045 variants in 29 genes.
- LOVD 2.0 has been tested to function properly when containing 5,000 genes, 1,000,000 mutations, 500,000 patients and 100,000 submitters.
- We offer LSDB curators the possibility to set up, with or without our help, their databases on our LOVD server free of charge. For more information see www.LOVD.nl.
- LOVD collaborates with UCSC and dbSNP to support display and access to DNA variants stored in LOVD-databases through genome browsers (see UCSC for dystrophy LSDBs and dbSNP for TSC1 and 2).

Some LOVD databases:

- Leiden Muscular Dystrophy pages (DMD, Sarcoglycans, LMNA, CAPN3, DYSF, ...)
• <http://www.dmd.nl/nmdb/>
- TCA Cycle Gene Mutation Database (Succinate dehydrogenase complex, ...)
• <http://chromium.liacs.nl/LOVD2/SDH/>
- dbPEX (Peroxisome Biogenesis Factor)
• <http://www.dbpex.org/>
- LOVD 2.0 shared (CLCN1, CREBBP, EP300, MSH6, MUTYH, ...)
• <http://chromium.liacs.nl/LOVD2/>
- LOVD 1.1.0 shared (TSC1 and TSC2, Fanconi Anemia genes, ATM, OTC, ...)
• <http://chromium.liacs.nl/lovd/>
- Center for Medical Genetics, Ghent, Belgium (FOXL2, NF1, ...)
• <http://medgen.ugent.be/LOVD2/>
- CCHMC Hearing Loss Mutation Database
• <http://bmi.cchmc.org/LOVD/>

www.LOVD.nl



LOVD

Leiden Open Variation Database

A flexible, free tool for gene-centered collection, curation and display of DNA variation

Exon	DNA change	RNA change	Protein	Re-site	Frequency	DB-ID	DNA remark
70	c.10102G>C	r.10102>p<	p.Asp3368His	-	-	DMD_01730	-
70	c.10108C>T	r.10108C>u	p.Arg3370X	-	-	DMD_00007	-
70	c.10121delA	r(?)	(p.Lys3374fArgpX3)	-	-	DMD_00438	-
70	c.10126delC	r.10126del	p.Leu3376X	-	-	DMD_00063	[OMIM 00261]
70	c.10133dupA	r(?)	(p.Asn3378LysfX55)	-	-	DMD_00244	-
70	c.10133delA	r(?)	(p.Asn3378ThrfX24)	-	-	DMD_00439	-
70	c.10134_10137del	r(?)	(p.Lys3379delFxfX3401)	-	-	DMD_00284	-
70	c.10135A>T	r.10135A>u	p.Lys3379X	-	-	DMD_01670	-
70	c.10144C>T	r(?)	(p.Arg3381X)	-	-	DMD_00067	[OMIM 00671]
70	c.10171dupC	r(?)	(p.Arg3391ProffX43)	-	-	DMD_01766	-
70	c.10171C>T	r.10171C>u	p.Arg3393X	-	-	DMD_00243	-
70	c.10179_10186delinsTCTAAGA	r(?)	(p.Tyr3394_Phe3396delinsLpfx6)	-	-	DMD_01131	-
70	c.10186C>T	r(?)	(p.Pro3396Ser)	-	-	DMD_00758	-
70	c.10202T>G	r.10202>g	p.Leu3403X	-	-	DMD_00173	-
70	c.10203delA	r.10203del	p.Glu3402ArgfX11	-del	-	DMD_00719	-
70	c.10204_10209del	r(?)	p?	-	-	DMD_00771	-
70	c.10205delA	r(?)	(p.Glu3402GlyfX11)	-	-	DMD_01120	-
70	c.10223+1G>C	r.sp1?	p.fs?	-	-	DMD_00157	-
70	c.10223+10>A	r.sp1?	p.fs?	-	-	DMD_00068	[OMIM 00681]
70	c.10223+2dupT	r.sp1?	p.fs?	-	-	DMD_00237	-
70	c.10223+30>A	r.sp1?	p.fs?	-	-	DMD_01885	-
70	c.10223+3G>C	r.sp1?	p.fs?	-	-	DMD_00238	-
70	c.10223+3del	r.sp1?	p.fs?	-	-	DMD_01196	-
70	c.10223+5G>C	r.sp1?	p.fs?	-	-	DMD_00069	[OMIM 00691]
70	c.10223+142T>C	r(?)	p.(=)	-	0.01	DMD_01574	-

LSDB-in-a-Box

www.LOVD.nl

Leiden University Medical Center, Leiden, Netherlands
Ing. Ivo F.A.C. Fokkema, Dr. Johan T. den Dunnen



Access levels

LOVD 2.0 features five access levels, all with different rights.

The *Database Administrator* has full access to LOVD. There is only one account of this type and it is created during LOVD installation. The DB administrator has all rights.

A *LOVD DB Manager* has access to the LOVD Setup, with rights closely similar to the Database Administrator but a Manager cannot uninstall LOVD and is not allowed to create or edit other Manager accounts. The LOVD DB Manager creates gene databases (LSDBs), structures the data to be collected and displayed and manages the curators (per gene).

A *Curator* has access to specific genes, but no access to the LOVD Setup. The Curator has control over the sequence variants, performs gene-specific configuration tasks (setting up gene custom columns), decides which data are public and curates incoming submissions.

Through registration, a *Submitter* creates an account facilitating submission of sequence variants to the database. Other than this a Submitter only has access to the public part of the LOVD gene databases.

A website Visitor can view of all curated submissions that part of the data that has been labeled to be public.

Main features

LOVD 2.0 is an "LSDB-in-a-Box", i.e. all functionalities to establish, manage and curate a web-based gene specific DNA variant database (LSDB) are included.

LOVD 2.0, a completely rewritten version of LOVD 1.1.0, contains a large number of new features. The system's internal efficiency been improved and the flexibility and user options have been extended greatly while maintaining LOVD's ease of use.

Sequence variant data and patient data are now stored separately. This allows one to link DNA variants in several genes to one patient. The pathogenicity of each variant can be set by submitter and curator, allowing one to easily separate disease causing from non-pathogenic variants. Submitters can add all variants in a patient in one submission but adding additional variants or adding existing variants to a different patient is just as easy.

LOVD 2.0 introduces powerful new search functionality based on that of the curator in LOVD 1.1.0. Searching variant and patient records can be performed per column and allows the use of boolean search terms (AND, OR and NOT).

LOVD 2.0 has enhanced possibilities to import new data through text files containing variant and patient data. Importing is now independent of the order of the columns and optional columns can be left out. During import the data are checked for internal consistency and uniqueness (accidental import of duplicate data is blocked).

As requested by existing users, submitter accounts can now be managed by DB manager and curators.

Flexibility

Compared to the previous release, LOVD 2.0 has many new settings that can be configured by DB managers and curators, given ample possibilities to customize an LSDB as desired. The custom column feature includes functionality to, on a per gene basis, add new columns, specify their content (e.g. text, numerical) and determine their collection (e.g. click box, drop-down menu). Custom columns are connected directly to the submission form and support explanation and examples to guide submitters. LOVD 2.0 comes with a set of HGVS recommended pre-configured variant and patient columns, which can be added by curators and managers in a click.

Modules

Extension of LOVD 2.0 functionality can be achieved in a very simple way using modules. Without requiring extensive programming, a module can directly affect LOVD forms by adding, editing or removing fields or buttons. Modules can store their own database settings. Authorized users can install, enable, disable or uninstall modules.

One available module is Mutalyzer, which allows submitters and curators to check the correct description of variant data in relation to the reference sequence or Genbank file used and to predict the effect of the variant on the RNA and protein level.

Planned is to extend the module system to support more extensive additions to have more influence in LOVD and to create a XML import/export module, to aid in standardization of variant and patient data flow between the various available online services.

Required software

LOVD is an "LSDB-in-a-Box" completely based on Open Source software. Besides LOVD all additional software required is common, freely available and usually already installed on the server of a hosting provider; with an standard account a MySQL database may not be included (or is optional). Obtaining all software for an LOVD installation should be simple.

- *Apache HTTP webserver*
(other webserver can be used, we encourage Apache 1.3 or up)
- *PHP scripting language* (version 4.2.0 and up)
- *MySQL database* (version 3.23.33 and up)

The software requirements for LOVD 2.0 have changed slightly. Compared to LOVD 1.1.0, support for older versions of PHP and MySQL has been stopped. The LOVD required versions of PHP and MySQL have been available for many years, reducing the chance that your server needs to be upgraded to support LOVD 2.0. Support for MySQL versions older than 4.0 will be discontinued in upcoming LOVD releases.