

# Ontologies Langage OWL

## IMGT-ONTOLOGY

**Application à la formalisation des concepts de  
description d'IMGT-ONTOLOGY  
avec l'éditeur Protégé**

# Plan

## 1- Cours

- Ontologies
- le Web sémantique
- Le langage OWL
- Exemples d'ontologies en biologie.

## 2- Domaine d'application en immunogénétique:

IMGT, The international ImMunoGenetics information system  
IMGT-ONTOLOGY

## 3- Application

- Formalisation des concepts de description

En philosophie, l'**ontologie** est l'étude de l'être en tant qu'être, c'est-à-dire l'étude des propriétés générales de ce qui existe.

Une ontologie est un **ensemble structuré de connaissances** dans un domaine particulier (comme par exemple celui de l'immunogénétique).

Une ontologie cherche à en représenter le sens (sémantique).

**Nécessité de définir un vocabulaire standardisé utilisé dans le domaine de connaissance**

**Quelle est la signification des termes dans le contexte?**

**=> Terminologie + définition pour chaque terme.**

**Comment ces termes sont-ils organisés?**

**Comment sont-ils reliés?**

**=> Propriétés: elles expriment les relations entre les connaissances**

# Ontologies

Une **ontologie** définit formellement les **termes** employés pour **décrire et représenter un domaine de connaissance.**

**Les ontologies sont destinées à être utilisées par:**

- **des personnes**
- **des bases de données**
- **des applications**

**ayant besoin de partager des informations**

# Ontologies

Au sein d'une ontologie, les termes sont regroupés sous forme de **concepts** (ou classes) sémantiques: ils définissent un groupe d'individus (**instances**) possédant des propriétés similaires.

Les ontologies regroupent les concepts élémentaires, leur **définition** (informatiquement exploitable) et leurs **relations**.

Les ontologies doivent permettre le **partage** et la **réutilisation des connaissances**.

## Bases de connaissances:

Une ontologie ainsi que l'ensemble des **instances** individuelles des **concepts** constituent une base de connaissances. Une frontière subtile marque la fin d'une ontologie et le début d'une base de connaissances.

# World Wide Web

(Créé par Tim Berners Lee en 1990)

=> Pour partager des informations/connaissances et les relier

**IMGT Index**

Here you are: [IMGT](#) > [Web resources](#) > [IMGT Index](#)

## Ontology (IMGT-ONTOLOGY)

- [Introduction](#)
- [IMGT-ONTOLOGY axioms and concepts](#)

An ontology is a concise and non ambiguous description of the more significant and relevant concepts in a application domain. IMGT-ONTOLOGY [1], is the first ontology which allows the management of the immunogenetics knowledge for all vertebrate species.

**Citing IMGT-ONTOLOGY:**

- Giudicelli, V. and Lefranc, M.-P. "Ontology for Immunogenetics: IMGT-ONTOLOGY", *Bioinformatics*, 15, 1047-1054 (1999) PMID: 10745995, LIGM:221, [PDF](#)
- Lefranc, M.-P. et al. "IMGT-ONTOLOGY for Immunogenetics and Immunoinformatics", *http://www.imgt.org*", *In Silico Biology*, 2004, 4, 17-29. [Epub 2003, 4, 0004](#), LIGM:278, PMID: 15089751
- Lefranc, M.-P. et al. "IMGT-Choreography for Immunogenetics and Immunoinformatics", *In Silico Biology*, 2005, 5, 45-60, [Epub 2005, 5, 0006, 24 Dec 2004](#), LIGM:294, PMID: 15972004
- Duroux, P. et al., "IMGT-Kaleidoscope, the Formal IMGT-ONTOLOGY paradigm", *Biochimie*, 90, 570-583 (2008). [Epub 2007 Sep11](#). PMID: 17949886

## Introduction

The molecular synthesis and genetics of the immunoglobulin (IG) and T cell receptor (TR) chains and the polymorphism of the MHC are particularly complex, and therefore one of the first tasks of IMGT-ONTOLOGY comprises a formal specification of the terms to be used in the domain of immunogenetics and bioinformatics [2-8].

IMGT-ONTOLOGY includes a controlled vocabulary and annotation rules which are indispensable to ensure accuracy, consistency and coherence in IMGT® [5]. IMGT-ONTOLOGY allows scientists and clinicians to use identical terms with the same meaning. This provides a semantic repository to be included in more general molecular biology ontologies, and will be therefore of a great help to increase interoperability between specialist and generalist databases.

## IMGT-ONTOLOGY axioms and concepts

Seven IMGT-ONTOLOGY axioms have been defined [1,6-8]: '**IDENTIFICATION**', '**DESCRIPTION**', '**CLASSIFICATION**', '**NUMEROTATION**', '**LOCALIZATION**', '**ORIENTATION**', and '**OBTENTION**'. They constitute the Formal IMGT-ONTOLOGY or IMGT-Kaleidoscope [9,10].

The IMGT-ONTOLOGY concepts of identification, description, classification, numerotation, localization, orientation and obtention were generated from these axioms and described in ref. [1,2,6-8].

Concepts of [interaction](#) that are necessary to define interactions between entities were defined based on these concepts.

Terminé

# World Wide Web

- Les ressources sous forme de page HTML (Langage HTML)
- Les relations entre ses pages qui se traduisent par des liens hypertextes

**IMGT Index**

Here you are: [IMGT Web resources](#) > [IMGT Index](#)

## Ontology (IMGT-ONTOLOGY)

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**Citing IMGT-ONTOLOGY:**

- Giudicelli, V. and Lefranc, M.-P. "Ontology for Immunogene
- Lefranc, M.-P. et al. "IMGT-ONTOLOGY for Immunogenetic
- Lefranc, M.-P. et al. "IMGT-Choreography for Immunogene

### Introduction

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Click here for:

- [Figures illustrating some of the IMGT-ONTOLOGY axioms and concepts](#) (IMGT Education).
- [Correspondence between the IMGT-ONTOLOGY concepts and the IMGT Scientific chart rules](#) (IMGT Scientific chart).
- [Scientific chart rules and ontologies report](#) PDF

Marie-Paule Lefranc, François Ehrenmann, Patrice Duroux and Véronique Giudicelli  
(D1.2 ImmunoGrid, The European Virtual Human Immune System Project, IST-2004-028069)  
*Describes the IMGT-ONTOLOGY concepts of identification, description and classification at the molecular level, generated from the IDENTIFICATION, DESCRIPTION and CLASSIFICATION axioms of the Formal IMGT-ONTOLOGY (IMGT-Kaleidoscope).*

Line 643, Col 1

Source of: <http://imgt.cines.fr/textes/IMGTIndex/ontology.html> - Mozilla Firefox

```
<h3 id="keyConcepts">IMGT-ONTOLOGY axioms and concepts</h3>

<p>
Seven IMGT-ONTOLOGY axioms have been defined <a href="#refs">[1,6-8]</a>:
<strong>'<a href="Identification.html">IDENTIFICATION</a>',
'<a href="Description.html">DESCRIPTION</a>',
'<a href="Classification.html">CLASSIFICATION</a>',
'<a href="Numerotation.html">NUMEROTATION</a>',
'LOCALIZATION',
'<a href="Orientation.html">ORIENTATION</a>',</strong>
and <strong>'<a href="Obtention.html">OBTENTION</a>'</strong>.
They constitute the Formal IMGT-ONTOLOGY or IMGT-Kaleidoscope <a href="#refs">[9,10]</a>.</p>
<p>
The IMGT-ONTOLOGY concepts of identification, description, classification,
numerotation, localization, orientation and obtention
were generated from these axioms and described in ref. <a href="#refs">[1,2,6-8]</a>.
</p>
```

[http://imgt.cines.fr/textes/PDF/D1.2\\_ImmunoGrid.pdf](http://imgt.cines.fr/textes/PDF/D1.2_ImmunoGrid.pdf)

# World Wide Web

## Limites

- **Balises HTML: la connaissance est encapsulée dans une couche de présentation**
- **Les liens hypertexte ne permettent pas de qualifier les relations entre les informations**
- **La qualité des pages est très hétérogène**

⇒ **Ces informations ne sont pas exploitables automatiquement**

# World Wide Web Consortium (W3C, <http://www.w3.org>)

(créé en 1994)

- Développement de technologies (spécifications, guides, logiciels et outils)
- Proposition des standards, pour la croissance et l'exploitation du Web

En particulier, en 1998, le langage de balisage extensible XML (Extensible Markup Language) devient une recommandation du W3C

- XML devrait pouvoir être utilisé sans difficulté sur Internet
- Les documents XML devraient être lisibles par l'homme et raisonnablement clairs
- Il devrait être facile de créer des documents XML
- Il devrait être facile d'écrire des programmes traitant les documents XML

ENA AM947564 - Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

HighQuest admin page x ENA AM947564 x +

http://www.ebi.ac.uk/ena/data/view/AM947564

Les plus visités Débuter avec Firefox À la une

EMBL-EBI Enter Text Here Find Help Feedback

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**ENA**

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- Search & Browse
- Submit & Update
- About ENA
- Contact

**Text search** Sequence search

Enter or paste text or ENA accession number. Upload file of ENA accessions:

Parcourir... Clear Search

**EMBL-Bank: AM947564.1**: Homo sapiens partial IGHV gene for immunoglobulin heavy chain variable region, patient 4

View: **TEXT** FASTA XML Download: TEXT FASTA XML

Overview Source Features Other Features References Sequence Send Feedback

<b>Organism</b> Homo sapiens	<b>Molecule type</b> genomic DNA	<b>Topology</b> linear	<b>Data class</b> STD	<b>Taxonomic Division</b> HUM
<b>Sequence length</b> 287	<b>Sequence Version</b> 1	<b>First public</b> 01-APR-2008	<b>Last updated</b> 01-APR-2008	

**Lineage**  
Eukaryota, Metazoa, Chordata, Craniata, Vertebrata, Euteleostomi, Mammalia, Eutheria, Euarchontoglires, Primates, Haplorrhini, Catarrhini, Hominidae, Homo

**Navigation**

- Taxon: 9606
- IMGT/LIGM: AM947564
- SVA: AM947564

**Overview** Top

Visible feature range: 1 - 287 Apply

**Overview** Forward strand 287 bp

AM947564.1

**Features** Forward strand 287 bp

1 bp 287 bp

Source: Homo sapiens

Genes: IGHV

CDS: IGHV

V\_region: IGHV

**Source Feature(s)** Top

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# Séquence EMBL AM947564

Mozilla Firefox

HighVquest admin page x http://www.ebi.ac.uk/ena/data/view/AM947564&display=text

http://www.ebi.ac.uk/ena/data/view/AM947564&display=text ebi embl

Les plus visités Débuter avec Firefox À la une

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ID AM947564; SV 1; linear; genomic DNA; STD; HUM; 287 BP.
XX
AC AM947564;
XX
DT 01-APR-2008 (Rel. 95, Created)
DT 01-APR-2008 (Rel. 95, Last updated, Version 1)
XX
DE Homo sapiens partial IGHV gene for immunoglobulin heavy chain variable
DE region, patient 4
XX
KW .
XX
OS Homo sapiens (human)
OC Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi; Mammalia;
OC Eutheria; Euarchontoglires; Primates; Haplorrhini; Catarrhini; Hominidae;
OC Homo.
XX
RN [1]
RP 1-287
RA Capello D.;
RT ;
RL Submitted (13-MAR-2008) to the EMBL/GenBank/DDBJ databases.
RL Capello D., Clinical & Experimental Medicine, University of Eastern
RL Piedmont, Via Solaroli, 17 Novara, 28100, ITALY.
XX
RN [2]
RA Capello D., Martini M., Gloghini A., Cerri M., Rasi S., Deambrogi C.,
RA Rossi D., Spina M., Tirelli U., Larocca L., Carbone A., Gaidano G.;
RT "Molecular analysis of immunoglobulin variable genes in HIV-related non
RT Hodgkin lymphoma reveals implications for disease pathogenesis and
RT histogenesis";
RL Unpublished.
XX
DR IMGT/LIGM; AM947564.
XX
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FH /isolate="patient 4"
FH /mol_type="genomic DNA"
FH /cell_type="B lymphocyte-derived lymphoma"
FH /tissue_type="HIV-related B-cell non-Hodgkin's lymphoma"
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# Séquence AM947564 en format XML

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C:\Documents and Settings\veronique.giudicelli\Local Settings\Temp\AM947564.xml
Fichier Edition Affichage Favoris Outils ? Convertir Sélectionner
Favoris Sites suggérés Galerie de composants W...
C:\Documents and Sett... x Internet Explorer Galerie
- <entry accession="AM947564" version="1" entryVersion="1" dataClass="STD" taxonomicDivision="HUM" moleculeType="genomic DNA"
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</reference>
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</reference>
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- <lineage>
<taxon scientificName="Eukaryota" />
Terminé Poste de travail 100%
```

# RDF : Resource Description Framework

Créé en 1999 pour décrire les **métadonnées** dans l'objectif de **traiter** l'information **automatiquement**, de favoriser **l'interopérabilité** des connaissances et de **structurer** les informations.

**Métadonnées:** information permettant d'en décrire une autre

- Les métadonnées sont habituellement comprises comme des données à propos des données.
- Un catalogue de bibliothèque contient de l'information (métadonnées) à propos de publications (données)
- Un système de fichier informatique définit des droits de lecture, écriture, etc. (métadonnées) à propos des fichiers (données).

# RDF

- **Standard du W3C**
- **Basé sur XML**
- **Un début vers un Web structuré**
- **RDF emploie les URI comme schéma de nommage**  
**(pour éviter la confusion entre termes identiques mais différents**  
**sémantiquement selon le contexte)**
- **On peut tout décrire**
- **Grande souplesse quand à l'extensibilité**

**URI: Uniform Resource Identifier**

# RDF

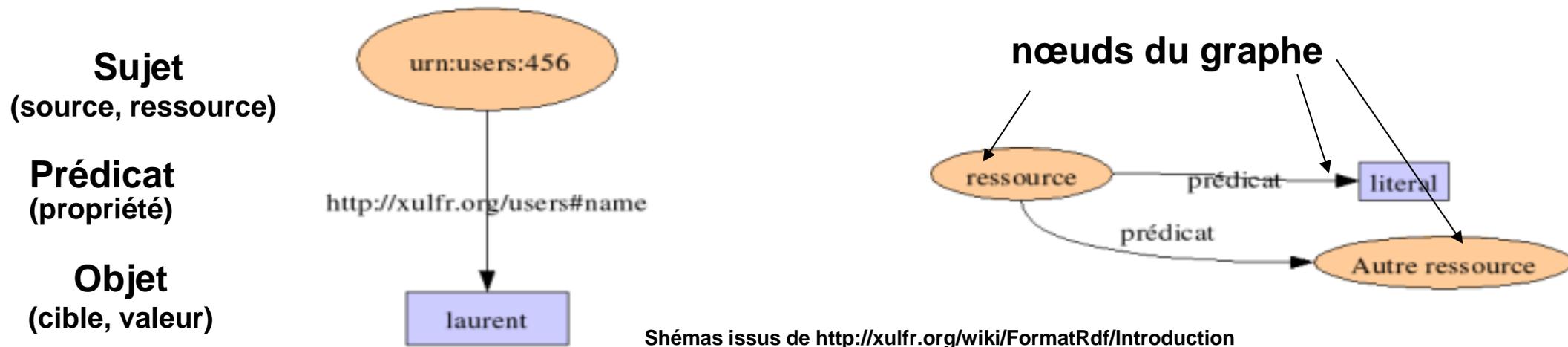
RDF se base sur une description des connaissances à l'aide de phrases simples :

C'est un moyen d'exprimer des relations.

Ces relations sont décrites sous forme de graphe.

Chaque nœud du graphe est une ressource ou une valeur.

Et chaque nœud est relié à un autre par un arc "nommé"



**=> Ceci correspond à un lien qui comporte un sens :  
c'est du Web sémantique**

**Les objectifs du Web sémantique sont de partager les connaissances et de pouvoir les manipuler automatiquement.**

**Pour ceci, il faut :**

- **qualifier le savoir (à l'aide de métadonnées),**
- **le formaliser en utilisant une syntaxe extensible (par exemple avec XML) et**
- **le structurer pour éviter les duplications.**

# ONTOLOGIE

Sur le plan informatique, les ressources sont définies les unes par rapport aux autres selon un graphe. Cette structure permet une automatisation de la manipulation des données.

Différence entre une thésaurus et une ontologie :

- Un **thésaurus** relie des concepts entre eux selon des relations précises : synonyme, homonyme, hiérarchie, terme associé.
- Une **ontologie** ajoute des règles et des outils de comparaison sur et entre les termes, groupes de termes et relations : équivalence, symétrie, contraire, cardinalité, transitivité.

=> Dans cet objectif RDF est trop limité en particulier, il ne permet pas de donner la nature des relations (transitive inverse, ..), possède une logique trop limitée pour faire du raisonnement

# OWL (Web Ontology Language)

**En 2004, OWL devient une recommandation du W3C**

**OWL découle de RDF et RDFS, possède des connecteurs logiques, d'exprimer des cardinalités sur les propriétés et d'en spécifier la nature.**

**Une ontologie formalisée en OWL comprend**

**Un espace de nom, :**

**L'entête <owl :Ontology> pour décrire l'ontologie**

**La définition des classes, des propriétés et des instances**

# Classes, sous-classes, héritage et spécialisation

Exemple des les formes géométriques: représentation hiérarchique de concepts avec la relation « is\_a »

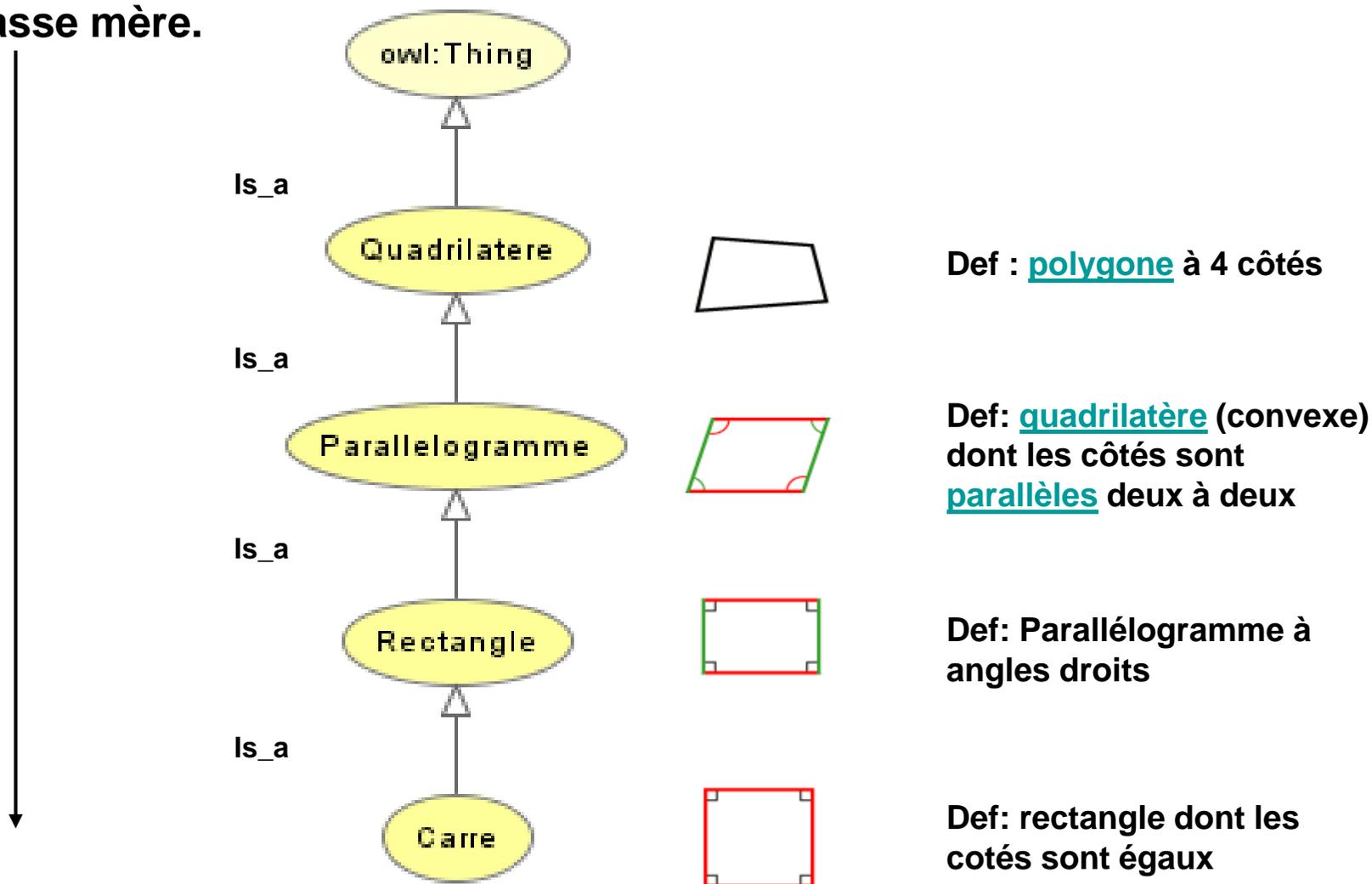
(OWL, Web Ontology Language)

Notion de Classe :

Définit un groupe d'individus possédant des propriétés similaires.

Thing est la classe mère.

spécialisation



# Taxonomy : représentation hiérarchique de concepts avec la relation « is\_a »

Taxonomy browser (Homininae) - Mozilla Firefox

Echier Édition Affichage Historique Marque-pages Outils ?

Taxonomy browser (Homininae)

www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?mode=Undef&id=207598&lvl=3&lin=f&keep=1&srchmode=1&unlock

Rechercher

Lineage (full): [root](#); [cellular organisms](#); [Eukaryota](#); [Opisthokonta](#); [Metazoa](#); [Eumetazoa](#); [Bilateria](#); [Deuterostomia](#); [Chordata](#); [Craniata](#); [Vertebrata](#); [Gnathostomata](#); [Teleostomi](#); [Euteleostomi](#); [Sarcopterygii](#); [Tetrapoda](#); [Amniota](#); [Mammalia](#); [Theria](#); [Eutheria](#); [Euarchontoglires](#); [Primates](#); [Haplorrhini](#); [Simiiformes](#); [Catarrhini](#); [Hominoidea](#); [Hominidae](#)

o **Homininae** *Click on organism name to get more information.*

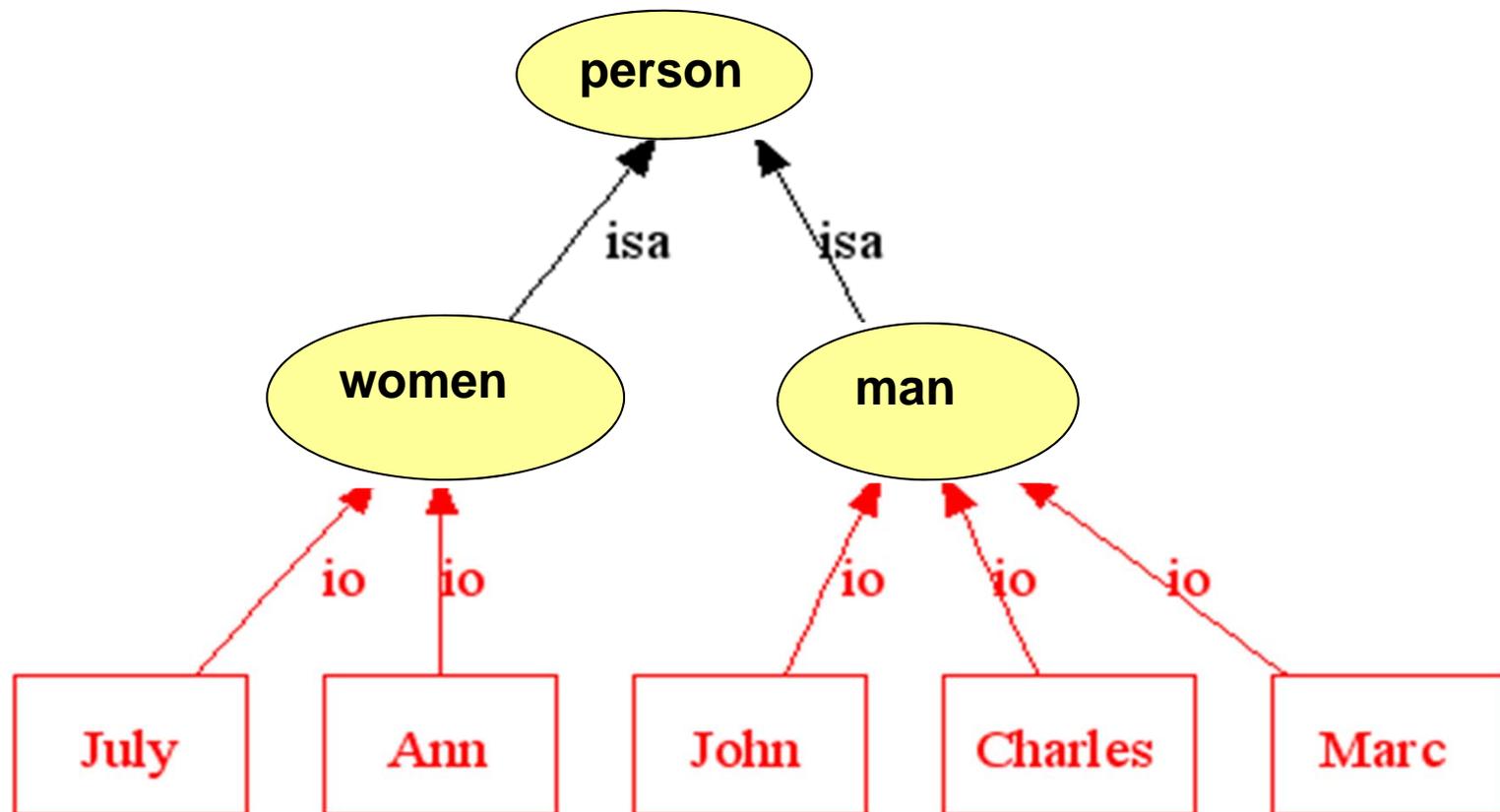
- o **Gorilla**
  - o **Gorilla beringei** (eastern gorilla)
    - **Gorilla beringei beringei** (eastern mountain gorilla)
    - **Gorilla beringei graueri** (eastern lowland gorilla)
  - o **Gorilla gorilla** (western gorilla)
    - **Gorilla gorilla diehli** (Cross River gorilla)
    - **Gorilla gorilla gorilla** (western lowland gorilla)
    - **Gorilla gorilla uellensis**
- o **Homo**
  - o **Homo sapiens** (human)
    - **Homo sapiens neanderthalensis** (Neand.)
    - **Homo sapiens ssp. Denisova** (Denisova hominin)
- o **Pan** (chimpanzees)
  - **Pan paniscus** (pygmy chimpanzee)
  - o **Pan troglodytes** (chimpanzee)
    - **Pan troglodytes ellioti**
    - **Pan troglodytes schweinfurthii**
    - **Pan troglodytes troglodytes**
    - **Pan troglodytes vellerosus**
    - **Pan troglodytes verus**

```
graph BT; Homininae --> Gorilla; Homininae --> Homo; Homininae --> Pan; Gorilla --> Gorilla_beringei[Gorilla beringei]; Gorilla --> Gorilla_gorilla[Gorilla gorilla]; Homo --> Homo_sapiens_neanderthalensis[Homo sapiens neanderthalensis]; Homo --> Homo_sapiens_Ssp_Denisova[Homo sapiens Ssp Denisova]; Pan --> Pan_paniscus[Pan paniscus]; Pan --> Pan_troglodytes[Pan troglodytes];
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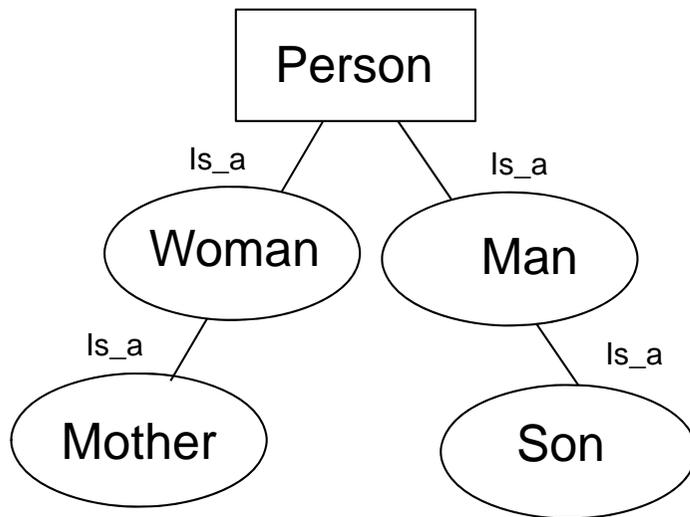
zotero

# Instances

Ce sont les « individus » qui peuplent les classes



# Propriétés/Relations (OWL, Web Ontology Language)



Existe-t-il des relations particulières  
Autres que « is\_a » :

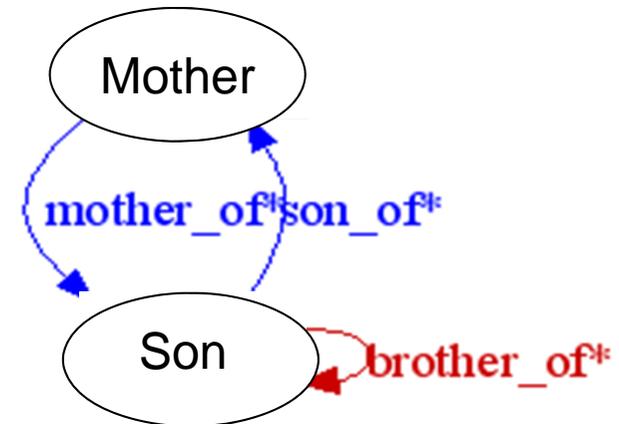
- fondamentales sur le plan sémantique
- caractéristiques des concepts/classes
- qui lient les concepts/classes entre eux?

# Propriétés/Relations (OWL, Web Ontology Language)

-Propriété : de type de données:  
classe =>ensemble de valeurs (numériques, alphabétique,...)

- date de naissance
- numéro de sécurité sociale
- .....

- Propriété d'objet : classe => classe



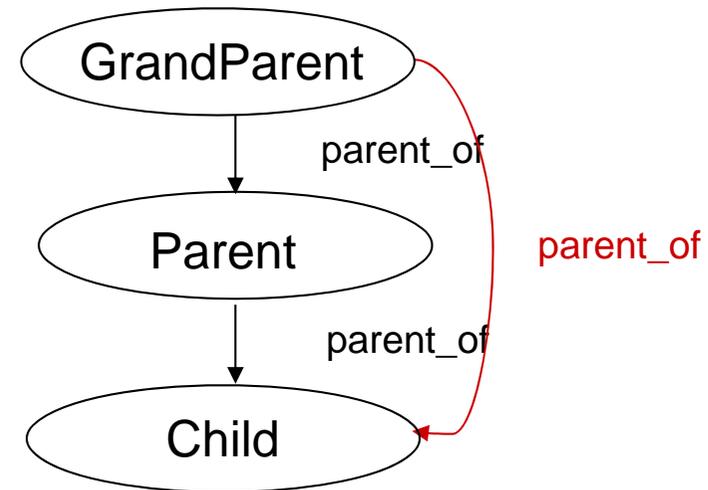
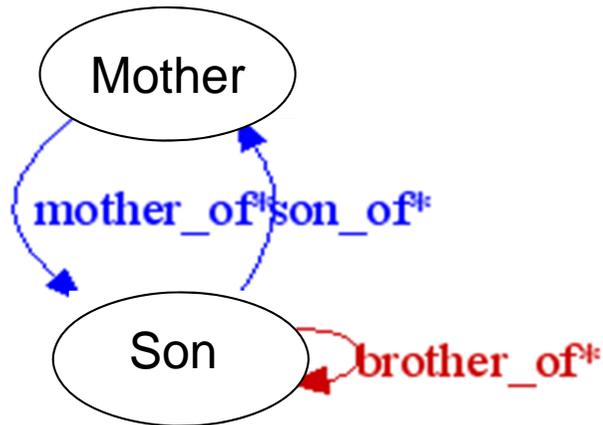
- Propriétés d'annotations: non héritées

# Définir et caractériser les Propriétés/Relations (OWL, Web Ontology Language)

domain : classes pour lesquelles est définie la propriété,  
range : classes reliées par la propriété au domain.

domain	relation	range
Son	brother_of	Son
Mother	mother_of	Son
Son	son_of	Mother

# Caractéristiques des Propriétés/rerelations: symétriques, transitives, inverses et fonctionnelles



(familles de 3 générations avec de jeunes enfants)

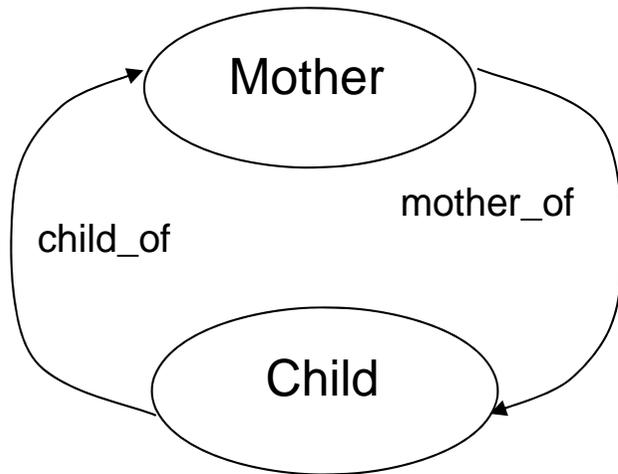
Symétrique: **brother\_of**

Transitive: parent\_of

Inverse: son\_of / mother\_of

Fonctionnelle : son\_of

# Restriction sur les Propriétés/Relations : cardinalités



Ex de familles nombreuses de moins de 10 enfants

- Une mère a au moins 3 enfants
- Une mère a au plus 10 enfants
- Un enfant a une et une seule mère

**minCardinality**: toute instance de la classe sera relié par la propriété à au moins x individus Exemple: propriété mother\_of de la classe Mother : minCardinality=3

**maxCardinality**: toute instance de la classe sera relié par la propriété à au plus x individus Exemple: propriété mother\_of de la classe Mother : maxCardinality=10

**cardinality**: toute instance de la classe sera relié par la propriété à exactement x individus Exemple: propriété son\_of de la classe Mother : cardinality=1

# Les ontologies en Biologie

- On s'intéresse aux ontologies qui sont du domaine public.
- Leur nombre augmente régulièrement (besoin de définir, de partager).
- Elles couvrent des sujets et domaines différents.

**NCBO Bioportal (<http://bioportal.bioontology.org/>)**

**OBO (Open Biological Ontologies) (<http://www.obofoundry.org/>)**

**recensent les ontologies en biologie.**

# NCBO Bioportal (<http://bioportal.bioontology.org/>)

Welcome to the NCBO BioPortal | NCBO BioPortal - Mozilla Firefox

bioportal.bioontology.org

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[Browse Ontologies >](#)

[Search resources](#)  
 [Search](#)  
[Advanced Resource Search](#)

[Most Viewed Ontologies \(April, 2013\)](#)

Ontology	Views
<a href="#">SNOMED Clinical Terms</a>	13,601
<a href="#">National Drug File</a>	9,320
<a href="#">MedDRA</a>	4,254
<a href="#">International Classification of Diseases</a>	3,415
<a href="#">NCI Thesaurus</a>	1,528

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 "A behavior that occurs in individuals that are p [Wikipedi...

[Body part movement is voluntary. \(Neuro Behav\) ago by anonymous](#)  
 As per title - please mo

[Incorrect classification \(Ontology\) 3 months ago](#)  
 Not all species that hav can independently mov

[RE: Antineoplastic anti \(NCI Thesaurus\) 3 mon](#)  
 Thank you for your con

[Latest Mappings](#)

[transfection \(Ontology for Biomedical Investigations\) => transfection \(Parasite Experiment Ontology\)](#)  
 BioPortal UI 04/20/13 uthaya

[transfection \(Parasite Experiment Ontology\) => transfection \(Ontology for Biomedical Investigations\)](#)  
 BioPortal UI 04/20/13 uthaya

[plasmid \(Ontology for Biomedical Investigations\) => sequence:plasmid \(Parasite Experiment Ontology\)](#)  
 BioPortal UI 04/20/13 uthaya

[sequence:plasmid \(Parasite Experiment Ontology\) => plasmid \(Ontology for Biomedical Investigations\)](#)  
 BioPortal UI 04/20/13 uthaya

[region \(Ontology for Biomedical Investigations\) => sequence:region \(Parasite Experiment\)](#)

bioportal.bioontology.org/#

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# NCBO Bioportal

Ontology Listing | NCBO BioPortal - Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

AmiGO: Term Details for GO:0007067 Taxonomy browser (Homininae) Ontology Listing | NCBO BioPortal

bioportal.bioontology.org/ontologies

Les plus visités Débuter avec Firefox À la une

Rechercher Ask Facebook La musique Amazon YouTube 13° Montpellier, France Le Monde L'Equipe Options >>

BioPortal Browse Search Mappings Recommender Annotator Resource Index Projects Recently Viewed Sign In Help Feedback

## Browse

Browse the library of ontologies ?

**New:** [Configure](#) which ontologies you see in BioPortal

FILTER BY CATEGORY: All Categories

FILTER BY GROUP: All Groups

FILTER BY TEXT:

[Submit New Ontology](#)

[Subscribe to all updates](#)

ONTOLOGY NAME	VISIBILITY	TERMS	NOTES	REVIEWS	PROJECTS	UPLOADED	CONTACT
<a href="#">ABA Adult Mouse Brain (ABA)</a>	Public	<a href="#">913</a>	0	1	6	08/08/2009	Allen Institute for Brain Science
<a href="#">Adverse Event Reporting ontology (AERO)</a>	Public	<a href="#">391</a>	1	0	3	04/29/2013	Melanie Courtot
<a href="#">African Traditional Medicine (ATMO)</a>	Public	<a href="#">223</a>	2	3	4	06/28/2009	Ghislain Atemezing
<a href="#">AI/RHEUM (AIR)</a>	Public	<a href="#">681</a>	0	0	2	02/05/2010	May Cheh
<a href="#">Amino Acid (amino-acid)</a>	Public	<a href="#">46</a>	0	0	6	07/02/2010	Nick Drummond, Georgina Moulton, Robert Stevens, Phil Lord
<a href="#">Amphibian gross anatomy (AAO)</a>	Public	<a href="#">1,603</a>	0	0	6	07/22/2011	David Blackburn
<a href="#">Amphibian taxonomy (ATO)</a>	Public	<a href="#">6,135</a>	0	0	3	11/02/2009	AmphiAnat list
<a href="#">Anatomic Pathology Lexicon (PathLex) (PathLex)</a>	Public	<a href="#">1,785</a>	0	0	0	01/22/2013	Christel Daniel
<a href="#">Anatomical Entity Ontology (AEO)</a>	Public	<a href="#">250</a>	0	0	3	06/01/2012	EMAP Administrators
<a href="#">Animal natural history and life history (ADW)</a>	Public	<a href="#">360</a>	0	0	2	08/31/2010	Animal Diversity Web technical staff
<a href="#">apollo-akesios (apollo)</a>	Public	<a href="#">3</a>	0	0	1	09/30/2010	Jeremy Espino

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# NCBI organismal classification

Terms

Jump To:

- root
  - cellular organisms
    - Archaea
    - Bacteria
    - Eukaryota**
  - other sequences
  - unclassified sequences
  - Viroids
  - Viruses
- taxonomic\_rank
  - class
  - family
  - forma
  - genus
  - infraclass
  - infraorder
  - kingdom
  - order
  - parvorder
  - phylum
  - species
  - species group
  - species subgroup
  - subclass
  - subfamily
  - subgenus
  - subkingdom
  - suborder
  - subphylum
  - subspecies
  - subtribe
  - superclass
  - superfamily
  - superkingdom
  - superorder

Details Visualization Notes (0) Term Mappings (9) Term Resources

Preferred Name	Eukaryota
Synonyms	"eukaryotes" "eucaryotes"
ID	NCBITaxon:2759
Full Id	<a href="http://purl.org/obo/owl/NCBITaxon#NCBITaxon_2759">http://purl.org/obo/owl/NCBITaxon#NCBITaxon_2759</a>
Database References	GC_ID
Exact Synonym	"eukaryotes" "eucaryotes"
Related Synonym	"eukaryotes" "Eucarya" "Eukarya" "Eucaryotae" "Eukaryotae"
Is A	<a href="#">cellular organisms</a>

# OBO (<http://www.obofoundry.org/>)

The Open Biological and Biomedical Ontologies - Mozilla Firefox

Echier Edition Affichage Historique Marque-pages Outils ?

The Open Biological and Biomedical Ontologies +

http://www.obofoundry.org/ obo ontology



## The Open Biological and Biomedical Ontologies

[Home](#) | [Contact](#)

[Ontologies](#) [Resources](#) [Participate](#) [About](#)

The OBO Foundry is a collaborative experiment involving developers of science-based ontologies who are establishing a set of principles for ontology development with the goal of creating a suite of orthogonal interoperable reference ontologies in the biomedical domain. The groups developing ontologies who have expressed an interest in this goal are listed below, followed by other relevant efforts in this domain.

In addition to a listing of OBO ontologies, this site also provides a statement of the OBO Foundry principles, discussion fora, technical infrastructure, and other services to facilitate ontology development. We welcome feedback and encourage participation.

Click any column header to sort the table by that column. The  link to the term request trackers for the listed ontologies.

### OBO Foundry ontologies

Title	Domain	Prefix	File	Last changed
<a href="#">Biological process</a>	biological process	GO	<a href="#">gene_ontology_edit.obo</a> 	2011/09/27
<a href="#">Cellular component</a>	anatomy	GO	<a href="#">gene_ontology_edit.obo</a> 	2011/09/27
<a href="#">Chemical entities of biological interest</a>	biochemistry	CHEBI	<a href="#">chebi.obo</a> 	2011/09/06
<a href="#">Molecular function</a>	biological function	GO	<a href="#">gene_ontology_edit.obo</a> 	2011/09/27
<a href="#">Phenotypic quality</a>	phenotype	PATO	<a href="#">quality.obo</a> 	
<a href="#">PRotein Ontology (PRO)</a>	proteins	PR	<a href="#">pro.obo</a> 	
<a href="#">Xenopus anatomy and development</a>	anatomy	XAO	<a href="#">xenopus_anatomy.obo</a>	2009/12/02
<a href="#">Zebrafish anatomy and development</a>	anatomy	ZFA	<a href="#">zebrafish_anatomy.obo</a> 	2011/07/15

### OBO Foundry candidate ontologies and other ontologies of interest

Title	Domain	Prefix	File	Last changed
<a href="#">Adverse Event Reporting Ontology</a>	health	AERO		
<a href="#">Amphibian gross anatomy</a>	anatomy	AAO	<a href="#">AAO_v2_edit.obo</a>	
<a href="#">Amphibian taxonomy</a>	anatomy	ATO	<a href="#">amphibian_taxonomy.obo</a>	
<a href="#">Anatomical Entity Ontology</a>	anatomy	AEO	<a href="#">aeo.obo</a>	2011/01/17
<a href="#">Ascomycete phenotype ontology</a>	phenotype	APO	<a href="#">ascomycete_phenotype.obo</a>	2011/03/28
<a href="#">Basic Formal Ontology</a>	upper	BFO	<a href="#">1.1</a>	
<a href="#">Bilateria anatomy</a>	anatomy	BILA	<a href="#">bilateria_mrca.obo</a>	
<a href="#">Biological imaging methods</a>	experiments	FBbi	<a href="#">image.obo</a>	2011/05/24
<a href="#">BRENDA tissue / enzyme source</a>	anatomy	BTO	<a href="#">BrendaTissueOBO</a>	
<a href="#">C. elegans development</a>	anatomy	WBIs	<a href="#">worm_development.obo</a>	2008/01/31
<a href="#">C. elegans gross anatomy</a>	anatomy	WBbt	<a href="#">WBbt.obo</a> 	
<a href="#">C. elegans phenotype</a>	phenotype	WBPhenotype	<a href="#">worm_phenotype.obo</a>	2011/09/19
<a href="#">Cell type</a>	anatomy	CL	<a href="#">cell.obo</a> 	2011/08/24
<a href="#">Chemical Information Ontology</a>	biochemistry	CHEMINF	<a href="#">cheminf.owl</a>	
<a href="#">Common Anatomy Reference Ontology</a>	anatomy	CARO	<a href="#">caro.obo</a> 	2011/09/12

#### Quick Links

- [★ Mappings between ontologies](#)
- [★ Download alternate formats](#)
- [★ About the OBO Foundry](#)
- [★ Current events](#)
- [★ How to join](#)
- [★ OBO Foundry paper in Nature Biotechnology, November 2007](#)

#### Other Ontology Lists

- [BioPortal](#) (NCBO's ontology repository)
- [Ontology Lookup Service \(OLS\)](#) (OBO Foundry term lookup)

# OBO (<http://www.obofoundry.org/>)

Ontology Name	Category	Identifier	URL	Created
<a href="#">Mosquito insecticide resistance</a>	environment	MIRO	<a href="#">mosquito_insecticide_resistance.obo</a>	2010/08/29
<a href="#">Mouse adult gross anatomy</a>	anatomy	MA	<a href="#">adult_mouse_anatomy.obo</a>	2010/04/04
<a href="#">Mouse gross anatomy and development</a>	anatomy	EMAP	<a href="#">EMAP.obo</a>	2007/06/17
<a href="#">Mouse pathology</a>	health	MPATH	<a href="#">mouse_pathology.obo</a>	2010/01/14
<a href="#">NCBI organismal classification</a>	taxonomy	NCBITaxon	<a href="#">taxonomy.dat</a>	
<a href="#">NCI Thesaurus</a>	health	ncithesaurus	<a href="#">EVS/</a>	
<a href="#">NIF Cell</a>	neuroscience	NIF_Cell	<a href="#">NIF-Cell.owl</a>	
<a href="#">NIF Dysfunction</a>	neuroscience	NIF_Dysfunction	<a href="#">NIF-Dysfunction.owl</a>	
<a href="#">NIF Gross Anatomy</a>	neuroscience	NIF_GrossAnatomy	<a href="#">NIF-GrossAnatomy.owl</a>	
<a href="#">NMR-instrument specific component of metabolomics investigations</a>	experiments	NMR	<a href="#">NMR.owl</a>	
<a href="#">OBO relationship types</a>	all	OBO_REL	<a href="#">ro.obo</a>	2010/06/07
<a href="#">Ontology for biomedical investigations</a>	experiments	OBID	<a href="#">obi.owl</a>	
<a href="#">Ontology for General Medical Science</a>	medicine	OGMS	<a href="#">ogms.owl</a>	
<a href="#">Pathogen transmission</a>	health	TRANS	<a href="#">transmission_process.obo</a>	2009/05/28
<a href="#">Pathway ontology</a>	biological process	PW	<a href="#">pathway.obo</a>	
<a href="#">Physico-chemical methods and properties</a>		FIX	<a href="#">fix.obo</a>	
<a href="#">Physico-chemical process</a>		REX	<a href="#">rex.obo</a>	2007/03/08
<a href="#">Plant environmental conditions</a>	environment	EO	<a href="#">environment_ontology.obo</a>	2009/01/09
<a href="#">Plant growth and developmental stage</a>	anatomy	PO	<a href="#">po_temporal.obo?view=co</a>	
<a href="#">Plant structure</a>	anatomy	PO	<a href="#">po_anatomy.obo?view=co</a>	
<a href="#">Platynereis stage ontology</a>	anatomy	PD_ST	<a href="#">Pdu_Stages.obo</a>	
<a href="#">Protein covalent bond</a>	proteins	RESID	<a href="#">RESIDUES.XML</a>	
<a href="#">Protein Domains</a>	proteins	IPR	<a href="#">InterPro FTP directory</a>	
<a href="#">Protein modification</a>	proteins	MOD	<a href="#">PSI-MOD.obo</a>	
<a href="#">Protein-protein interaction</a>	experiments	MI	<a href="#">psi-mi25.obo</a>	
<a href="#">Proteomics data and process provenance</a>	proteins	ProPreO	<a href="#">ProPreO-060506.owl</a>	
<a href="#">RNA ontology</a>	molecular structure	RNAO	<a href="#">rnao.obo</a>	
<a href="#">Sample processing and separation techniques</a>	provenance	SEP	<a href="#">sep.obo</a>	
<a href="#">Sequence types and features</a>	biological sequence	SO	<a href="#">so.obo</a>	2010/08/27
<a href="#">Software ontology</a>		SWO	<a href="#">softwareontology.owl</a>	
<a href="#">Spatial Ontology</a>	anatomy	BSPO	<a href="#">spatial.obo</a>	2010/05/18

# Gene Ontology.

- *GO* a été créée en 1998. *GO* résulte d'une collaboration entre plusieurs bases de données: FlyBase (drosophile), the Saccharomyces Genome Database, et des bases de données de génomes (homme et souris), etc.
- *GO* comprend 3 parties axées sur :
  - **la fonction moléculaire** (fonction des gènes exprimés ex: ATPase activity).
  - **le processus biologique** (rôles biologique généraux de fonctions moléculaire complexes ex: la mitose).
  - **les composants cellulaires** (structures subcellulaires, localisation des complexes macromoléculaires ex: le noyau, le télomère).

# Gene Ontology (<http://www.geneontology.org/>)

The screenshot shows the Gene Ontology website in a Mozilla Firefox browser. The browser's address bar displays [www.geneontology.org](http://www.geneontology.org). The website's header features the logo "the Gene Ontology" and a search bar with the text "gene or protein name" and a "go!" button. Below the header is a navigation menu with links for Downloads, Tools, Documentation, Projects, About, and Contact.

## Welcome to the Gene Ontology website!

The Gene Ontology project is a major bioinformatics initiative with the aim of standardizing the representation of gene and gene product attributes across species and databases. The project provides [a controlled vocabulary of terms](#) for describing gene product characteristics and [gene product annotation data](#) from GO Consortium members, as well as [tools to access and process this data](#). [Read more about the Gene Ontology...](#)

### Search the Gene Ontology Database

Search for genes, proteins or GO terms using [AmiGO](#):

gene or protein name  GO term or ID

[AmiGO](#) is the official GO browser and search engine. [Browse the Gene Ontology with AmiGO](#).

#### Quick Links

- Tools
- [AmiGO browser](#)
- Submit GO Annotations
- OBO-Edit ontology editor
- Ontology downloads
- Annotation downloads
- Database downloads
- Documentation
- GO FAQ
- [GO on SourceForge](#)
- Contact GO

#### News

- [GO on Twitter](#)
- Finding updates...

ABP x zotero

AmiGO: Term Search Results - Mozilla Firefox

amigo.geneontology.org/cgi-bin/amigo/search.cgi?search\_query=mitosis&search\_constraint=term&action=new-search

the Gene Ontology AmiGO

Search Browse BLAST Homolog Annotations Tools & Resources Help

Search GO   terms  genes or proteins  exact match

### Term Search Results

57 results for **mitosis** in terms fields **term accession, term name and synonyms**

▼ Filter search results ⓘ

Ontology:

- All
- biological process
- cellular component
- molecular function

Results are sorted by **relevance**. To change the sort order, click on the column headers.

1 2

Perform an action with this page's selected terms...

rel ↓	Accession , Term		Ontology
<input type="checkbox"/>	GO:0007067 : <b>mitosis</b> [show def]	3835 gene products <a href="#">view in tree</a>	<b>biological process</b>
<input type="checkbox"/>	GO:0051337 : <b>animitosis</b> [show def]	0 gene products <a href="#">view in tree</a>	biological process
<input type="checkbox"/>	GO:0010458 : <b>exit from mitosis</b> [show def]	338 gene products <a href="#">view in tree</a>	biological process
<input type="checkbox"/>	GO:0007088 : <b>regulation of mitosis</b> [show def]	1075 gene products <a href="#">view in tree</a>	biological process
<input type="checkbox"/>	GO:0055047 : <b>generative cell mitosis</b> [show def]	2 gene products <a href="#">view in tree</a>	biological process

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### Term Information

**Accession** GO:0007067  
**Ontology** Biological Process  
**Synonyms** None  
**Definition** A cell cycle process comprising the steps by which the nucleus of a eukaryotic cell divides; the process involves condensation of chromosomal DNA into a highly compacted form. Canonically, mitosis produces two daughter nuclei whose chromosome complement is identical to that of the mother cell.  
*Source:* GOC:dph, GOC:ma, GOC:mah, ISBN:0198547684  
**Comment** None  
**Subset** [Generic GO slim](#)  
**Community** [Add](#) usage comments for this term on the GONUTS wiki.

[Back to top](#)

### Term Neighborhood for mitosis (GO:0007067)

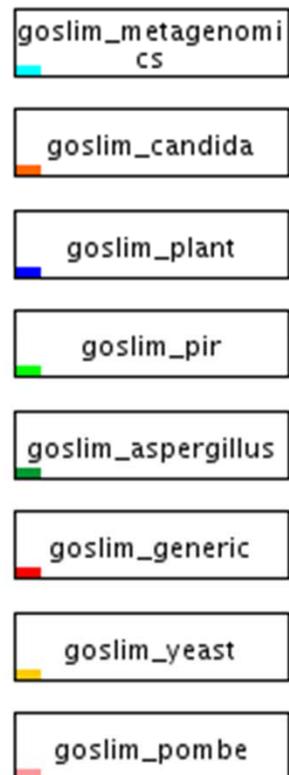
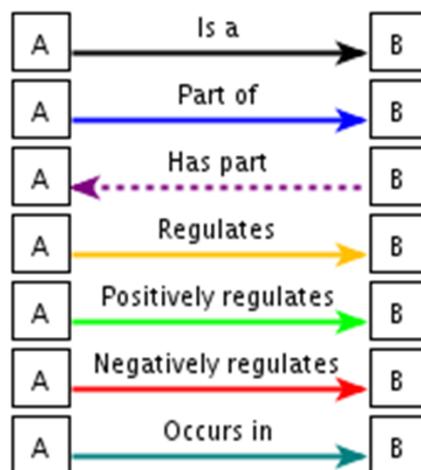
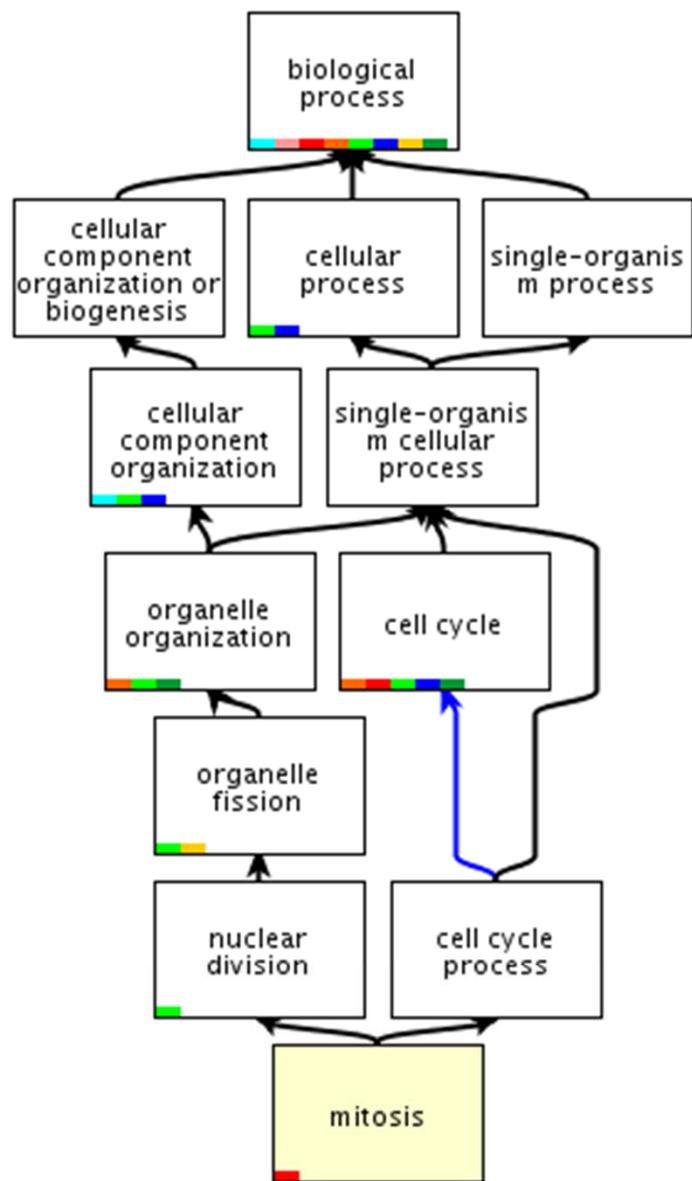
Filter lineage gene product counts

Data source	Species
No filter	No filter
ASAP	A. fumigatus
AspGD	A. niger
CGD	A. oryzae

[Ancestors and Children](#) |
 [Inferred Tree View](#) |
 [Graph View](#) |
 [Other Views](#) |
 [Downloads](#) |
 [Mappings](#)

#### Ancestors of mitosis (GO:0007067)

subject	relation	object	annotations
mitosis	part_of (inferred)	biological_process (GO:0008150)	501703
mitosis	is_a (inferred)	cellular component organization or biogenesis (GO:0071840)	61308
mitosis	is_a (inferred)	cellular component organization (GO:0016043)	54002
mitosis	part_of (inferred)	cellular process (GO:0009987)	287339
mitosis	part_of (inferred)	single-organism process (GO:0044699)	172947
mitosis	is_a (inferred)	organelle organization (GO:0006996)	29739
mitosis	part_of (inferred)	single-organism cellular process (GO:0044763)	142265



# Sequence Ontology

(<http://www.sequenceontology.org/>)

- Vocabulaire contrôlé pour l'annotation des séquences et l'annotation des génomes
- proposer une représentation structurée des annotations
- vocabulaire pour la description des mutations

# Sequence Ontology: une ontologie pour décrire les séquences biologiques

The screenshot shows a Mozilla Firefox browser window displaying the Sequence Ontology Project website. The browser's address bar shows the URL <http://www.sequenceontology.org/>. The website features a blue header with the 'SO' logo and the text 'The Sequence Ontology Project'. Below the header is a green navigation bar with links: Home, **Browser**, Wiki, GFF3, GVF, Resources, About, Request A Term, and Site Map. An orange arrow points to the 'Browser' link. The main content area includes a 'Welcome to the Sequence Ontology' section and a 'News' section with two entries.

**Welcome to the Sequence Ontology**

This is the home page of the Sequence Ontology Project (SO), a joint effort by genome annotation centres, and other groups using sequence annotation data, including: [WormBase](#), [FlyBase](#), the [Mouse Genome Informatics](#) group, and the [Sanger Institute](#). We are a part of the [Gene Ontology Project](#) and the [Open Biomedical Ontologies \(OBO\)](#). Our aim is to develop an ontology suitable for describing biological sequences. For questions, please send mail to the [SO developers mailing list](#)

**News**

- ▶ **March 2011** SOBA workshop presented at [GMOD Spring Training](#).
- ▶ **Feb 11th 2011** The CVS repository on [sourceforge](#) is back online after the hacking incident.

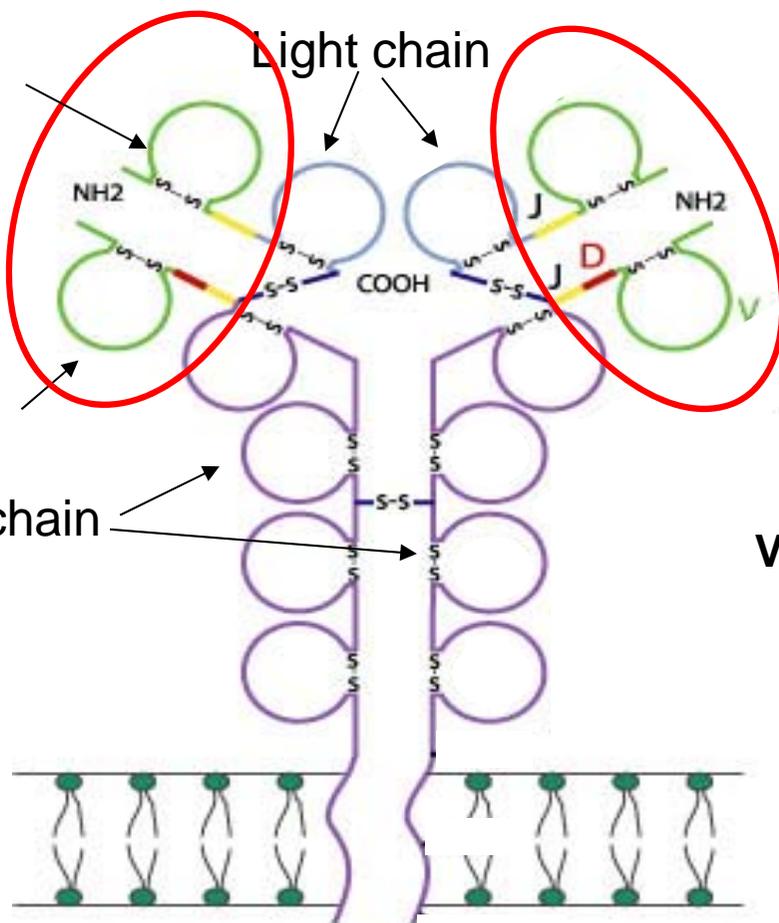


**Le système d'information  
IMGT, the international ImMunoGeneTics  
information system®  
<http://www.imgt.org>**

# Immunoglobulin (IG)

# T cell receptor (TR)

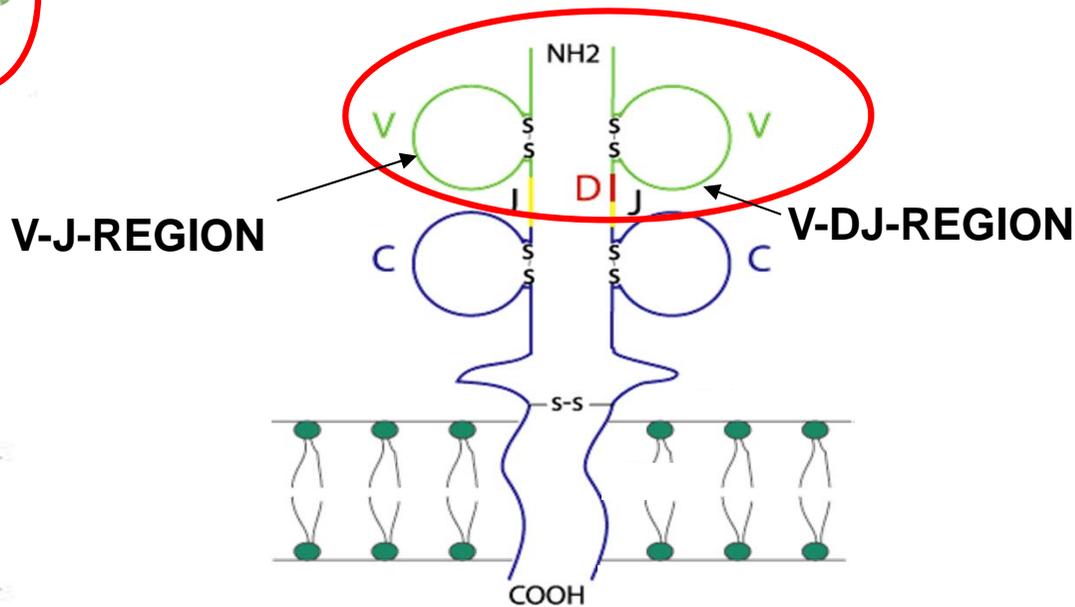
**V-DOMAIN**  
**V-J-REGION**



**Membrane IgM**

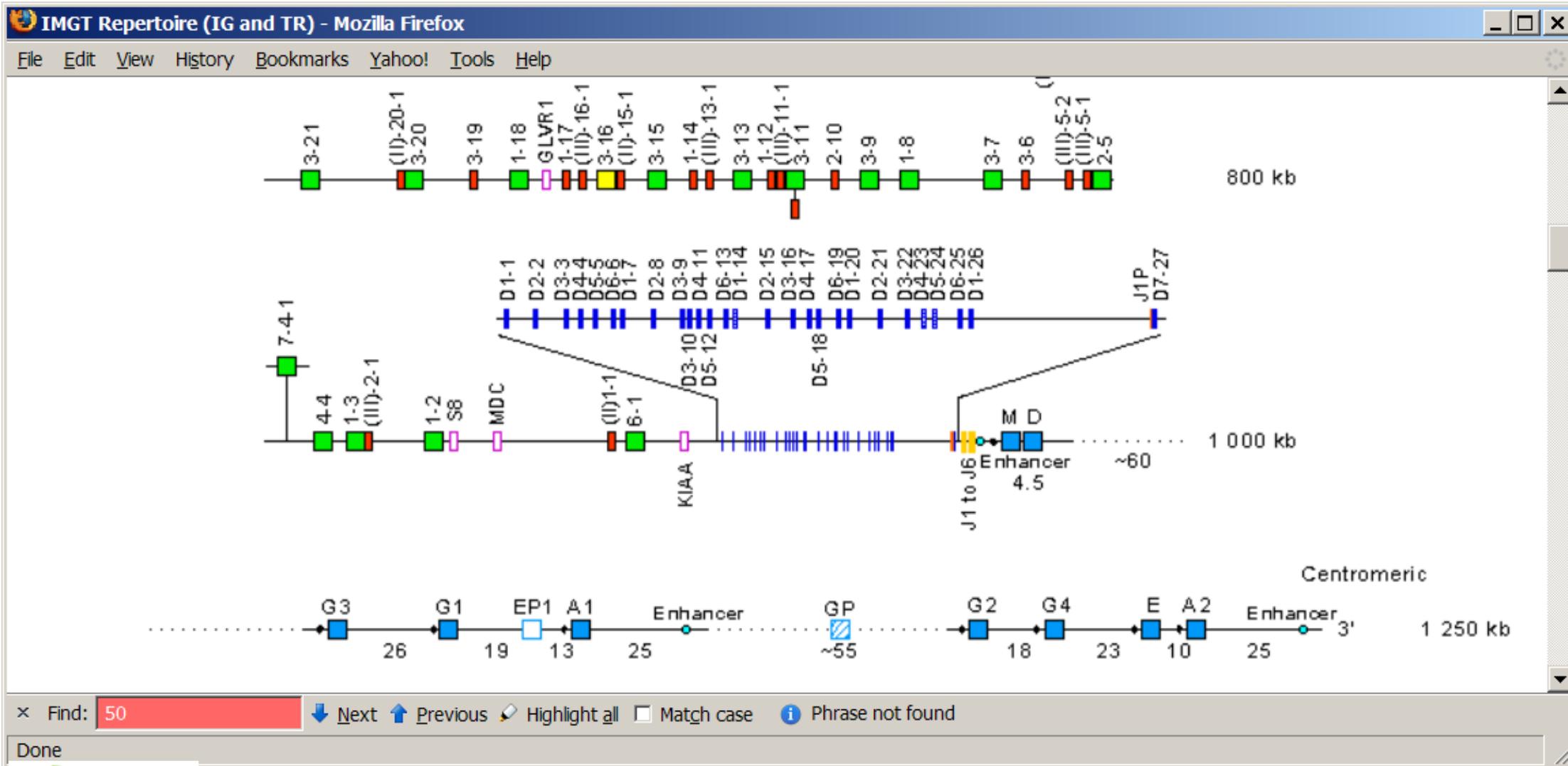
Contribution of the  
**2 V-DOMAINS**  
to the antigen binding site

Alpha - Beta  
Gamma - Delta

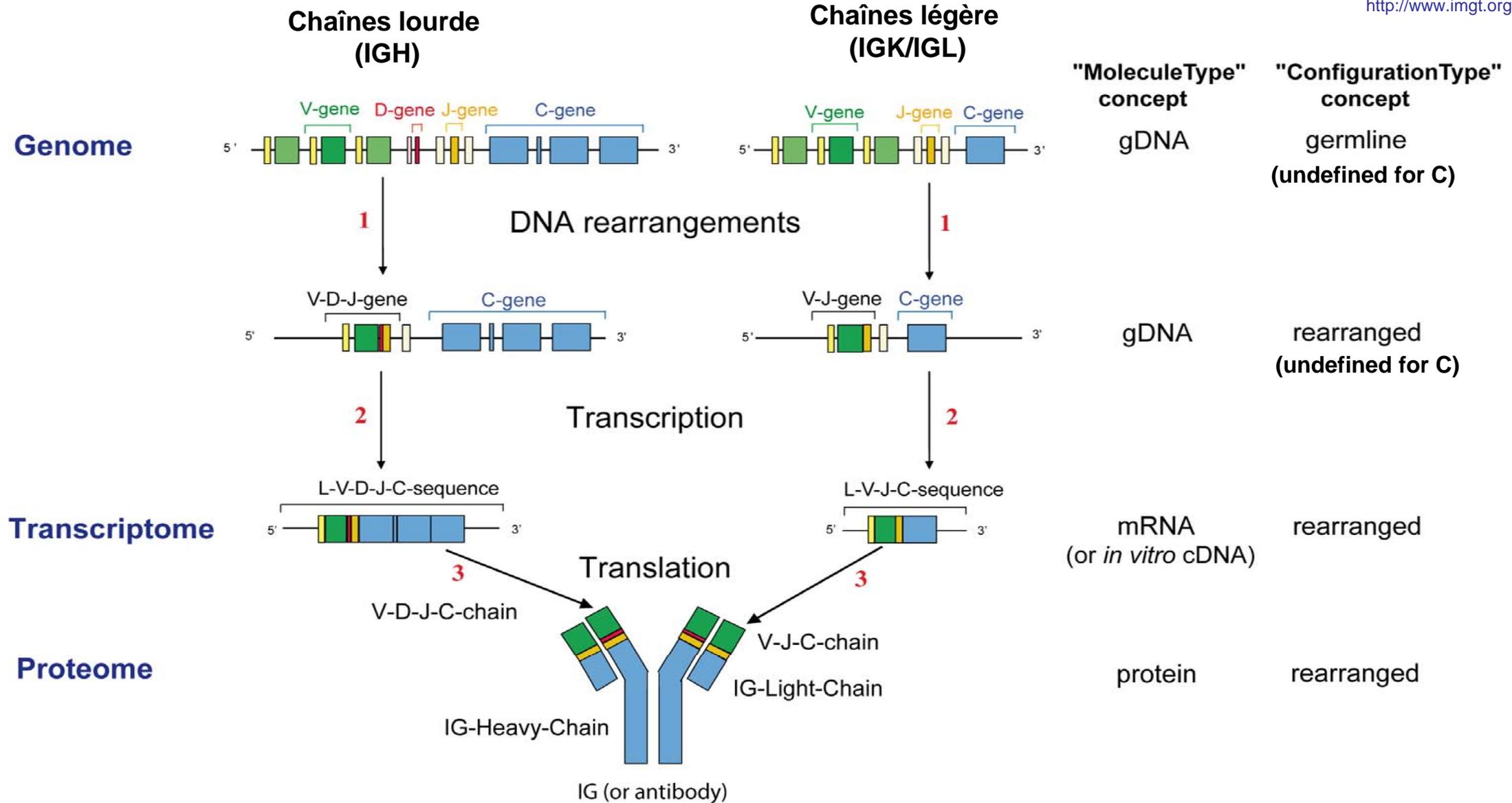


**T cell receptor**

# Part of Human (*Homo sapiens*) IGH locus on chromosome 14 (14q32.33)



# Synthèse des immunoglobulines



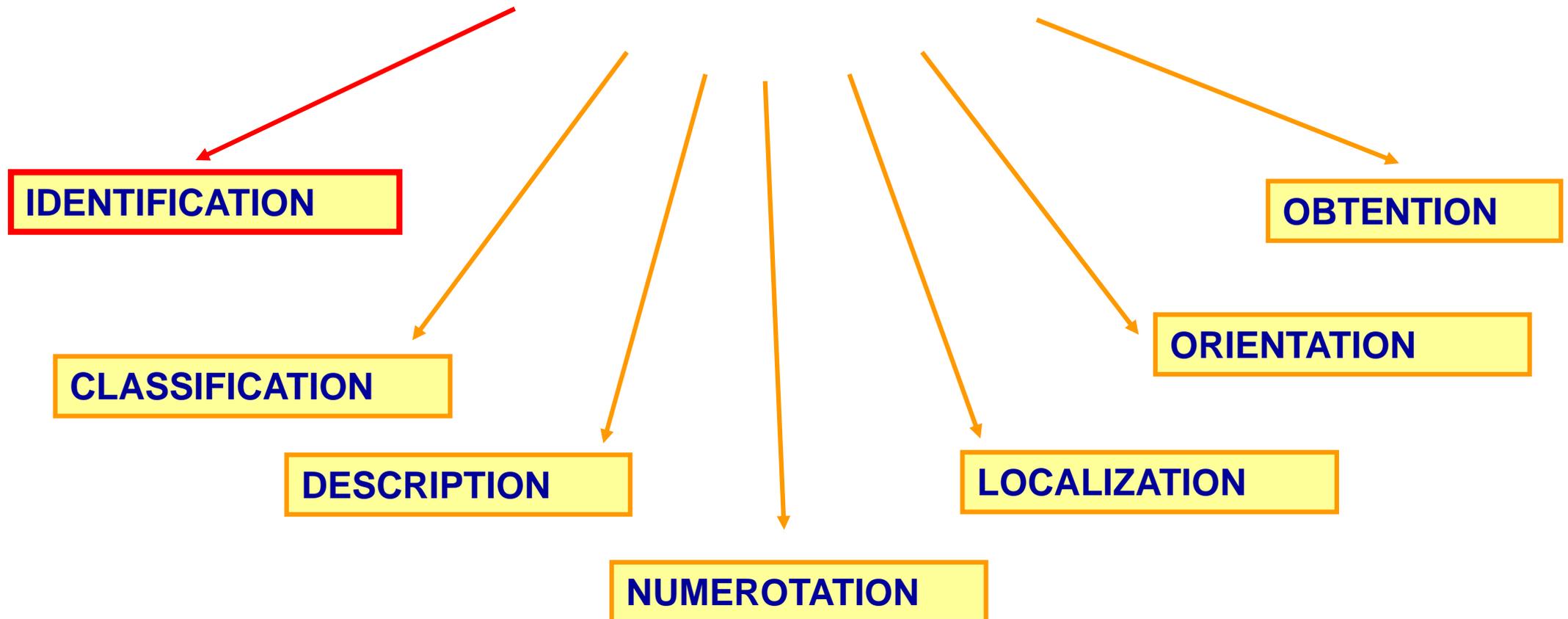
# Particularités des séquences IG et TR

- Elles sont nombreuses ( $2 \cdot 10^{12}$  IG par individu)
- Une forte similitude
- De petites différences très significatives
- Nécessité de standardiser la nomenclature des gènes

# IMGT-ONTOLOGY

Pour standardiser, partager, réutiliser et représenter  
les connaissances en immunogénétique

IMGT-ONTOLOGY repose sur 7 axiomes:



# IMGT-ONTOLOGY



## **IMGT Scientific chart :**

IMGT-ONTOLOGY en *langage naturel* pour les biologistes

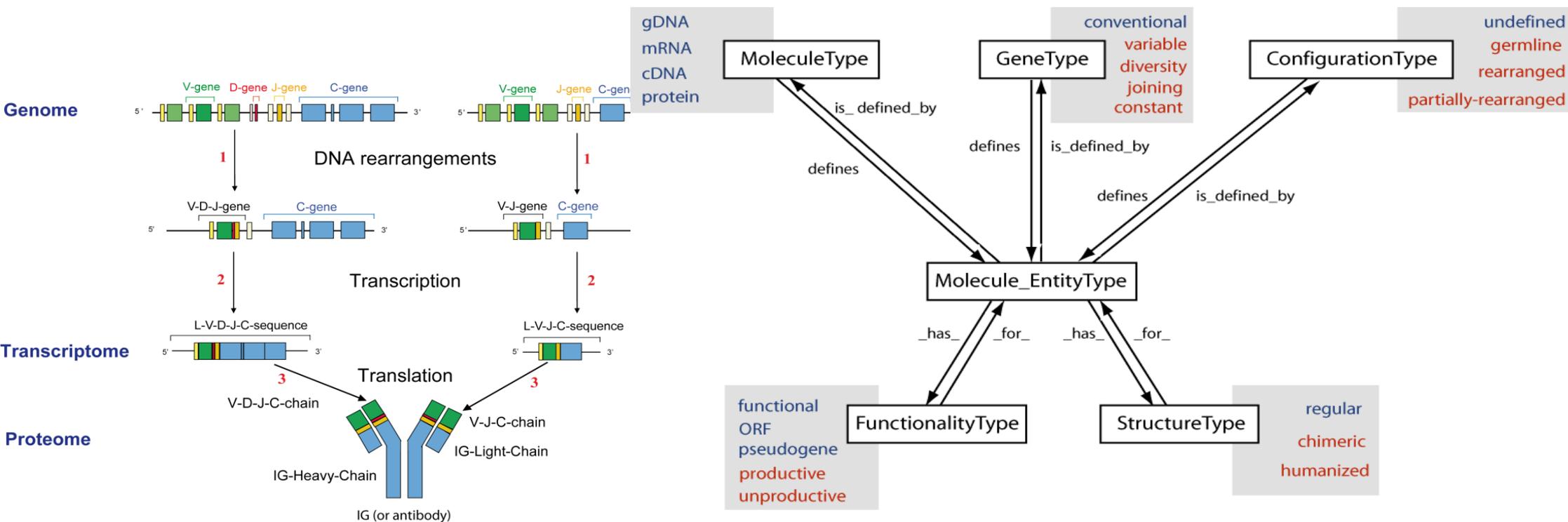
<http://imgt.cines.fr/textes/IMGTScientificChart/>

## **En cours : édition en langage OWL**

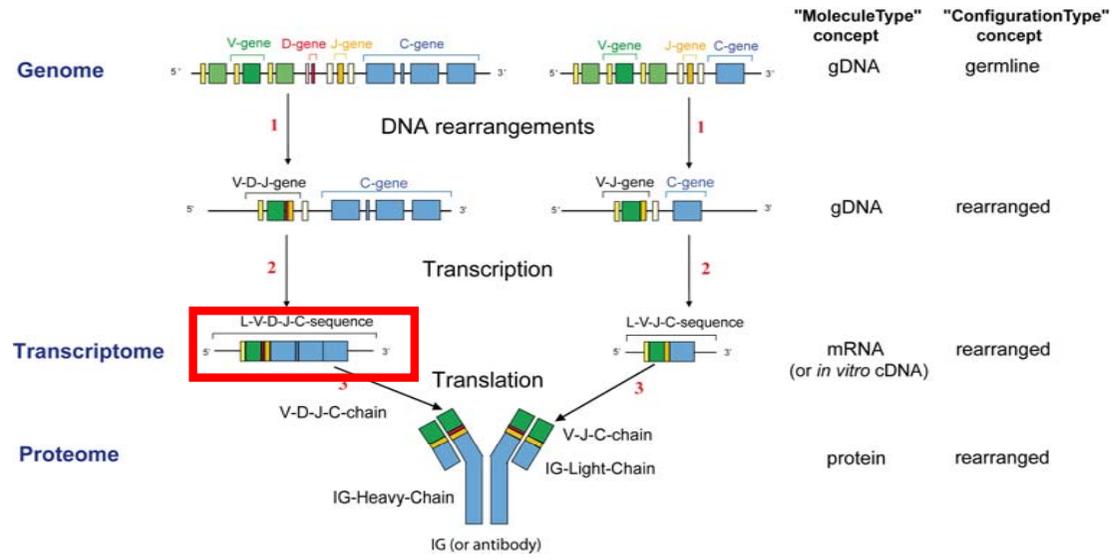
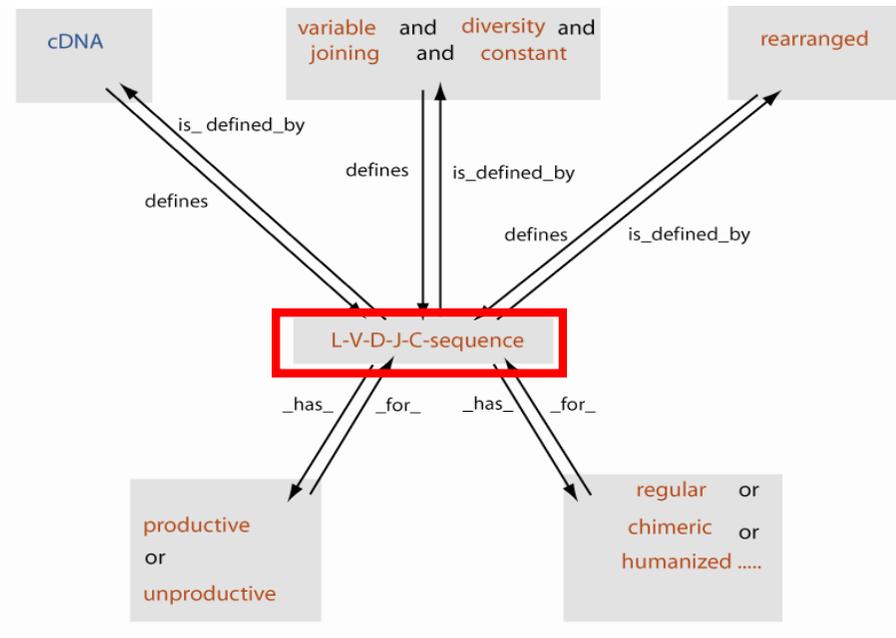
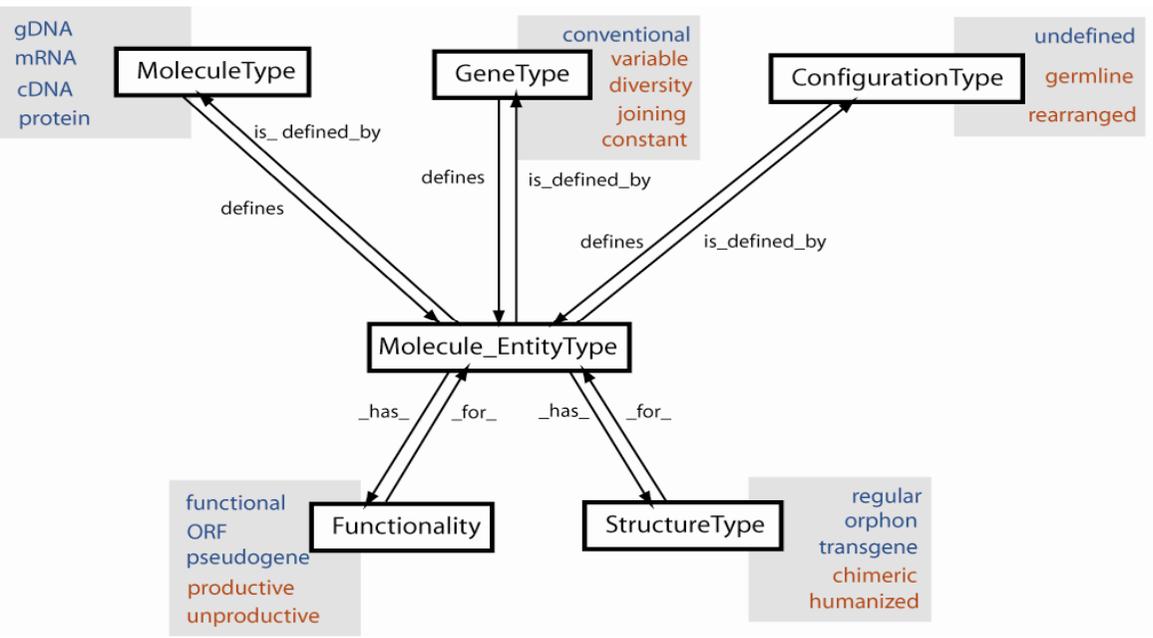
Version v1.0.0 sur le site BioPortal

(<http://bioportal.bioontology.org/visualize/42685>)

# Relationships between Molecule\_EntityType and the other IDENTIFICATION concepts



# Relationships between the L-V-D-J-C-sequence concepts and the other IDENTIFICATION concepts



IMGT Home page - Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

IMGT Home page

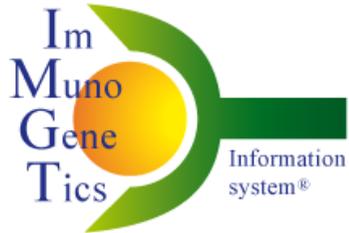
www.imgt.org

ncbo bioportal

Les plus visités Débuter avec Firefox À la une

# WELCOME ! to the IMGT Home page

THE INTERNATIONAL IMMUNOGENETICS INFORMATION SYSTEM®



<http://www.imgt.org>

IMGT®, the international ImMunoGeneTics information system® <http://www.imgt.org>, is the global reference in immunogenetics and immunoinformatics, created in 1989 by Marie-Paule Lefranc ([Université Montpellier 2](#) and [CNRS](#)). IMGT® is a high-quality integrated knowledge resource specialized in the immunoglobulins (IG) or antibodies, T cell receptors (TR), major histocompatibility (MH) of human and other vertebrate species, and in the immunoglobulin superfamily (IgSF), MH superfamily (MhSF) and related proteins of the immune system (RPI) of vertebrates and invertebrates. IMGT® provides a common access to sequence, genome and structure Immunogenetics data, based on the concepts of IMGT-ONTOLOGY and on the IMGT Scientific chart rules. IMGT® works in close collaboration with [EBI](#) (Europe), [DDBJ](#) (Japan) and [NCBI](#) (USA). IMGT® consists of [sequence](#) databases, [genome](#) database, [structure](#) database, and [monoclonal antibodies](#) database, [Web resources](#) and [interactive tools](#).

IMGT founder and director: [Marie-Paule Lefranc](#) ([Marie-Paule.Lefranc@iqh.cnrs.fr](mailto:Marie-Paule.Lefranc@iqh.cnrs.fr)), Université Montpellier 2, CNRS, [LIGM](#), [IGH](#), [SFR](#), Montpellier (France)

[IMGT® Site Map](#)  
[Information on IMGT®](#), [IMGT creations and updates](#), [IMGT references](#), [FAQ](#), [Citing IMGT](#), [Acknowledgments and Funding support](#)  
[IMGT Livre d'or](#)  
[The 2010 IMGT® Customer Satisfaction Survey](#)

The Quality Management System of IMGT® Montpellier France has been approved by Lloyd's Register Quality Assurance France SAS to the following [Quality Management System Standard: ISO 9001:2008](#)



### IMGT databases

-  [IMGT/LIGM-DB \(doc\)](#) LIGM, Montpellier, France  
 Nucleotide sequences of IG and TR from 335 species (**170 685 entries**)
-  [IMGT/MH-DB](#) ANRI, BPRC, hosted at EBI  
 Sequences of the human MH (HLA)
-  [IMGT/PRIMER-DB \(doc\)](#) LIGM, Montpellier, France  
 Oligonucleotides (primers) of IG and TR from 11 species (**1 864 entries**)
-  [IMGT/CLL-DB \(bylaws\)](#) LIGM, Montpellier, France  
 IG sequences from CLL, an initiative of the IMGT/CLL-DB group
-  [IMGT/GENE-DB \(doc\)](#) LIGM, Montpellier, France  
 International nomenclature for IG and TR genes from human, mouse, rat and rabbit (**3 077 genes, 4 669 alleles**)
-  [IMGT/3Dstructure-DB and IMGT/2Dstructure-DB \(doc\)](#) LIGM, Montpellier, France  
 3D structures (IMGT Colliers de Perles) of IG antibodies, TR, MH and RPI (**2 802 entries**)  
 Source: PDB, INN, Kabat

### IMGT Web resources

- [IMGT Repertoire](#) (IG and TR, MH and RPI)
- [IMGT Scientific chart](#) (Sequence description, Numbering, Nomenclature, Representation rules)
- [IMGT Index](#) (FactsBook)
- [IMGT Bloc-notes](#) (Interesting links, PubMed, Meeting announcements, Postdoctoral positions and jobs, Messages, Search engines...)
- [IMGT Education](#) (IMGT Lexique, Aide-mémoire, Tutorials, Questions and answers, Enseignements...)
- [IMGT Posters and diaporama](#)
- [The IMGT Medical page](#)
- [The IMGT Veterinary page](#)
- [The IMGT Biotechnology page](#)
- [The IMGT Immunoinformatics page](#)

zotero

# Les objectifs de IMGT/LIGM-DB



<http://www.imgt.org>

- Contenir toutes les séquences IG et TR des bases EMBL/GenBank/DDBJ
  - + de 170.000 séquences de 335 espèces
- Expertiser les séquences en fonction des connaissances en immunogénétique
  - identification des gènes,
  - description des motifs (régions codantes, ...)
- Suivi et intégration des nouvelles connaissances dans le système d'information IMGT®

# A l'arrivée dans IMG\_T®

IMG\_T/LIGM-DB - Mozilla Firefox

File Edit View History Bookmarks Tools Help

## EMBL FLAT-FILE

```
ID  AABR03051069; SV 1; linear; genomic DNA; WGS; ROD; 16176 BP.
XX
AC  AABR03051069; AABR03000000;
XX
DT  13-AUG-2003 (Rel. 76, Created)
DT  13-AUG-2003 (Rel. 76, Last updated, Version 1)
XX
DE  Rattus norvegicus chromosome 6 clone CH230-392J6; CH230-207C13;
DE  CH230-361I3; CH230-68G3; CH230-83C24; CH230-408M5; CH230-30N12;
DE  CH230-110O20; CH230-321B4; CH230-83D21; CH230-232G6; CH230-170A13;
DE  CH230-375C4; CH230-331M14; CH230-186O12; CH230-49E8; CH230-62J1;
DE  CH230-447G6 strain BN/SsNHsdMCW RNOR03303698, whole genome shotgun
DE  sequence.
XX
KW  WGS.
XX
OS  Rattus norvegicus (Norway rat)
OC  Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi; Mammalia;
OC  Eutheria; Euarchontoglires; Glires; Rodentia; Sciurognathi; Muroidea;
OC  Muridae; Murinae; Rattus.
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Done

# Après expertise dans IMGT®



<http://www.imgt.org>

IMGT/LIGM-DB - Mozilla Firefox

File Edit View History Bookmarks Tools Help

## IMGT FLAT-FILE

ID AABR03051069 IMGT/LIGM annotation : by annotators; genomic DNA; ROD; 16176 BP.

XX

AC AABR03051069; AABR03000000;

XX

DT 17-OCT-2006 (Rel. 200643-2, arrived in LIGM-DB )

DT 17-JUL-2007 (Rel. 200729-2, Last updated, Version 3)

yy

DE Rattus norvegicus chromosome 6 clone CH230-392J6; CH230-207C13;  
DE CH230-361I3; CH230-68G3; CH230-83C24; CH230-408M5; CH230-30N12;  
DE CH230-110O20; CH230-321B4; CH230-83D21; CH230-232G6; CH230-170A13;  
DE CH230-375C4; CH230-331M14; CH230-186O12; CH230-49E8; CH230-62J1;  
DE CH230-447G6 strain BN/SsNHsdMCW RNOR03303698, whole genome shotgun  
DE sequence. ;

DE genomic DNA; germline configuration; Ig-Heavy; regular; group IGHV.

XX

KW antigen receptor; immunoglobulin superfamily; IG; IG-Heavy; variable;

KW pseudogene; IMGT reference sequence; immunoglobulin; gDNA; germline;

KW V-gene.

xx

OS Rattus norvegicus (Norway rat)

OC cellular organisms; Eukaryota; Fungi/Metazoa group; Metazoa; Eumetazoa;

OC Bilateria; Coelomata; Deuterostomia; Chordata; Craniata; Vertebrata;

OC Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Tetrapoda;

OC Amniota; Mammalia; Theria; Eutheria; Euarchontoglires; Glires;

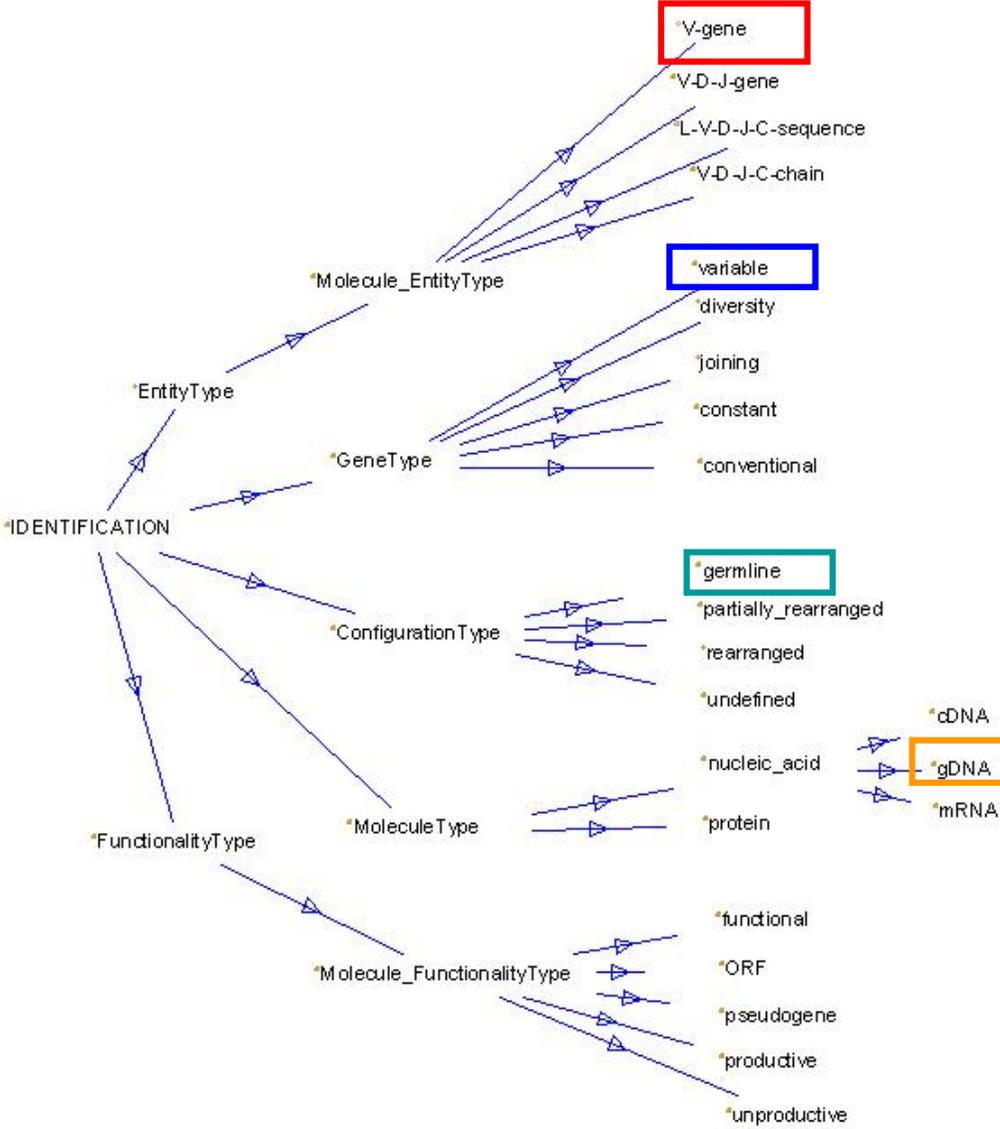
OC Rodentia; Sciurognathi; Muroidea; Muridae; Murinae; Rattus.

XX

**Identification  
de la séquence**

Done

# Result: the formalization of the relationships between concepts of IDENTIFICATION allows to represent the rules of the dependency between keywords used in IMGT® databases



## IMGT/LIGM-DB flatfile

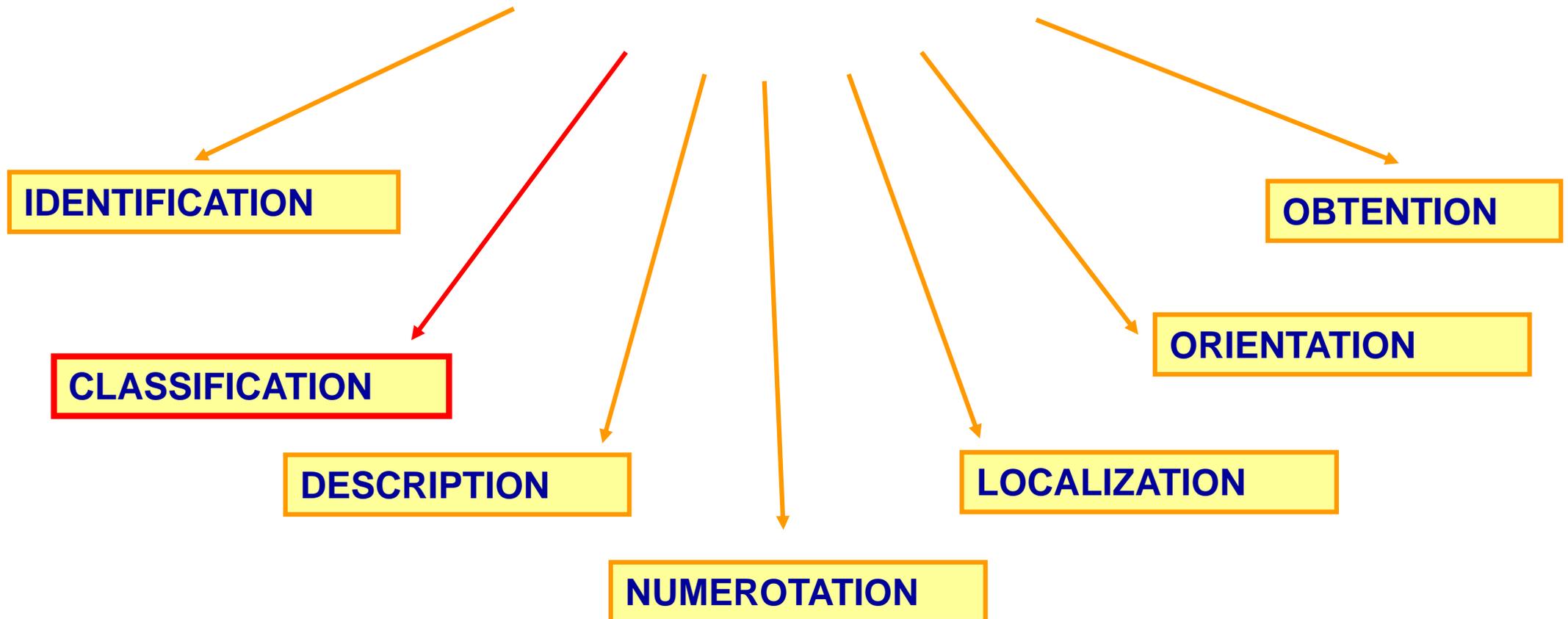
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ID X07448 IMGT/LIGM annotation : by annotators; genomic DNA; HUM; 618 BP.
XX
AC X07448;
XX
DT 15-MAY-1995 (Rel. 2, arrived in LIGM-DB )
DT 20-OCT-2008 (Rel. 200843-1, Last updated, Version 10)
XX
DE Human V35 gene for Ig heavy chain ;
DE genomic DNA; germline configuration; Ig-Heavy; regular; functionality
DE functional; group IGHV; subgroup HV1.
XX
KW antigen receptor; Immunoglobulin superfamily (IgSF);
KW immunoglobulin (IG); IG-Heavy; variable; IMGT reference sequence; gDNA;
KW germline; functional V-gene.
XX
OS Homo sapiens (human)
OC cellular organisms; Eukaryota; Fungi/Metazoa group; Metazoa; Eumetazoa;
OC Bilateria; Coelomata; Deuterostomia; Chordata; Craniata; Vertebrata;
OC Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Tetrapoda;
OC Amniota; Mammalia; Theria; Eutheria; Euarchontoglires; Primates;
OC Haplorrhini; Simiiformes; Catarrhini; Hominoidea; Hominidae;
OC Homo/Pan/Gorilla group; Homo.
XX
RN [1]
RP 1-618
RX PUBMED; 2841108.
RA Matsuda F., Lee K.H., Nakai S., Sato T., Kodaira M., Zong S.Q., Ohno H.,
RA Fukuhara S., Honjo T.;
RT "Dispersed localization of D segments in the human immunoglobulin
RT heavy-chain locus";
RL EMBO J. 7(4):1047-1051(1988).
XX
  
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# IMGT-ONTOLOGY

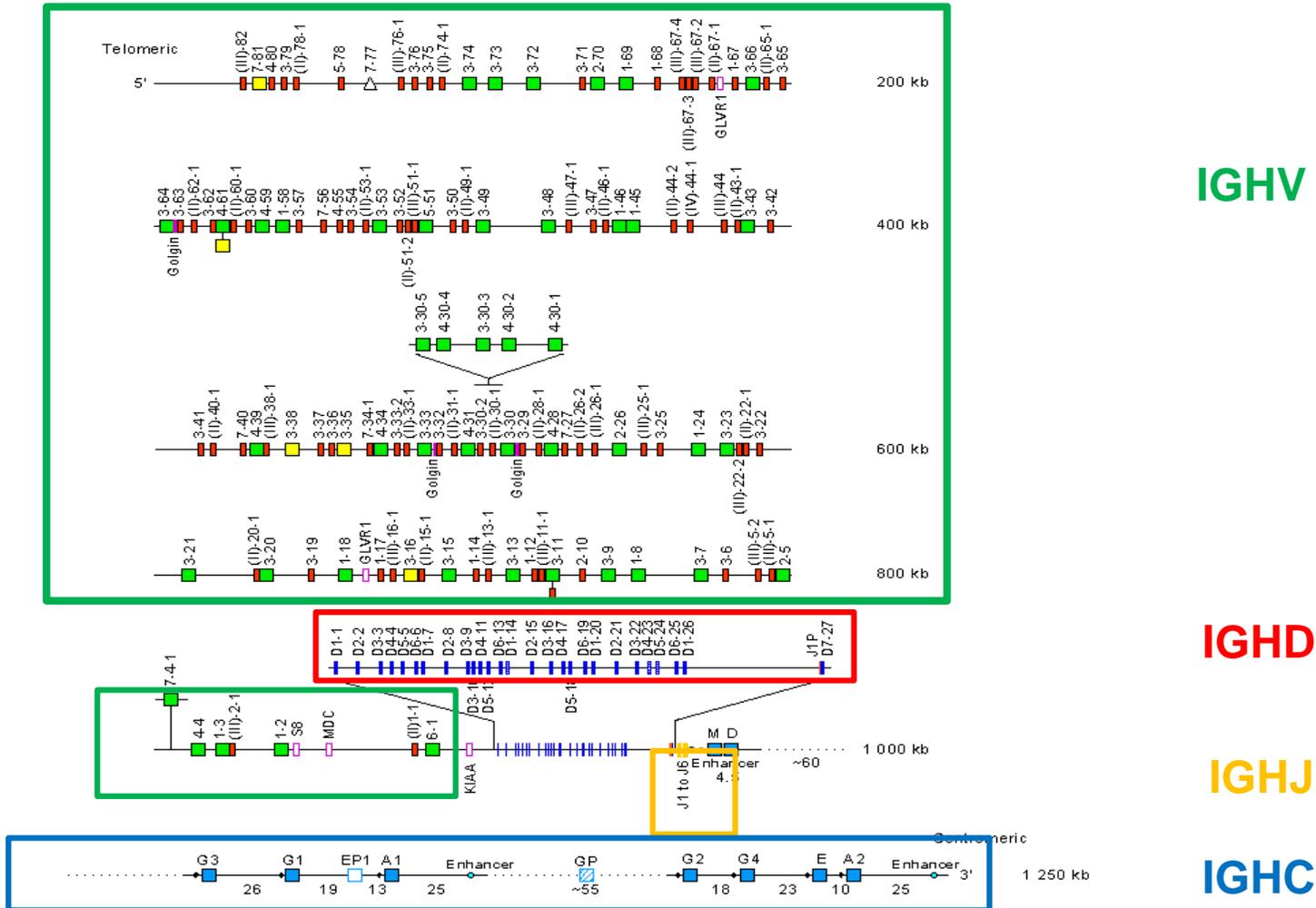
Pour standardiser, partager, réutiliser et représenter  
les connaissances en immunogénétique

IMGT-ONTOLOGY repose sur 7 axiomes:



# 2 – Concepts de classification d'IMGT-ONTOLOGY

Group: A group is a set of genes which share the same 'gene type' and participate potentially to the synthesis of a polypeptide of the same 'chain type'.



Human IGH locus on chromosome 14 (14q32.33)

# 2 – Concepts de classification d'IMGT-ONTOLOGY

## Subgroup:

A subgroup is a set of IG or TR genes (C-GENE, V-GENE, D-GENE, J-GENE) which belong to the same group, in a given species, and which share at least 75% identity at the nucleotide level (in the germline configuration for V, D, and J).

Species	Gene	Allele	AccNum	Domain label	Functionality	FR1-IMGT (1-26)		CDR1-IMGT (27-38)		FR2-IMGT (39-55)		CDR2-IMGT (56-65)		FR3-IMGT (66-104)		CDR3-IMGT (105-117)	
						A (1-15)	B (16-26)	BC (27-38)	C (39-46)	C' (47-55)	C' C'' (56-65)	C'' (66-74)	D (75-84)	E (85-96)	F (97-104)	FG (105-117)	
Human	IGLV1-36	IGLV1-36*01	Z73653	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV1-40	IGLV1-40*01	M94116	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV1-41	IGLV1-41*01	M94118	V-LAMBDA	ORF	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV1-44	IGLV1-44*01	Z73654	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV1-47	IGLV1-47*01	Z73663	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV1-50	IGLV1-50*01	M94112	V-LAMBDA	ORF	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV1-51	IGLV1-51*01	Z73661	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-NL1	IGLV2-NL1*01	Z22209	V-LAMBDA	P	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-5	IGLV2-5*01	Z73641	V-LAMBDA	P	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-8	IGLV2-8*01	X97462	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-11	IGLV2-11*01	Z73657	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-14	IGLV2-14*01	Z73664	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-18	IGLV2-18*01	Z73642	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-23	IGLV2-23*01	X14616	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-33	IGLV2-33*01	Z73643	V-LAMBDA	ORF	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV2-34	IGLV2-34*01	D87013	V-LAMBDA	P	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-1	IGLV3-1*01	X67826	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-9	IGLV3-9*01	X97473	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-10	IGLV3-10*01	X97464	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-12	IGLV3-12*01	Z73658	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-13	IGLV3-13*01	X97463	V-LAMBDA	P	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-16	IGLV3-16*01	X97471	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-19	IGLV3-19*01	X66178	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-21	IGLV3-21*01	X71966	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-22	IGLV3-22*01	Z73666	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-25	IGLV3-25*01	X97474	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-27	IGLV3-27*01	D86994	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-31	IGLV3-31*01	X97469	V-LAMBDA	P	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV3-32	IGLV3-32*01	Z73645	V-LAMBDA	ORF	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV4-3	IGLV4-3*01	X67828	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV4-60	IGLV4-60*01	Z73667	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV4-69	IGLV4-69*01	Z73648	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV5-37	IGLV5-37*01	Z73672	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV5-39	IGLV5-39*01	Z73668	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV5-45	IGLV5-45*01	Z73670	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV5-48	IGLV5-48*01	Z73649	V-LAMBDA	ORF	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV5-52	IGLV5-52*01	Z73669	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV6-57	IGLV6-57*01	Z73673	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV7-43	IGLV7-43*01	X14614	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV7-46	IGLV7-46*01	Z73674	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV8-61	IGLV8-61*01	Z73650	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV9-49	IGLV9-49*01	Z73675	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV10-54	IGLV10-54*01	Z73676	V-LAMBDA	F	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...
Human	IGLV11-55	IGLV11-55*01	D86996	V-LAMBDA	ORF	QSVLTQPPS.VS	ASGTP	GORVTIISCTGS	SSNIG...	AGYD	VHWYQQLP	GTAPKLLIY	GN.....	NRPSGVP.D	RFSGSK..	TSASLAITGLQA	EDEADY* QSYDSSLG...

human IGLV1

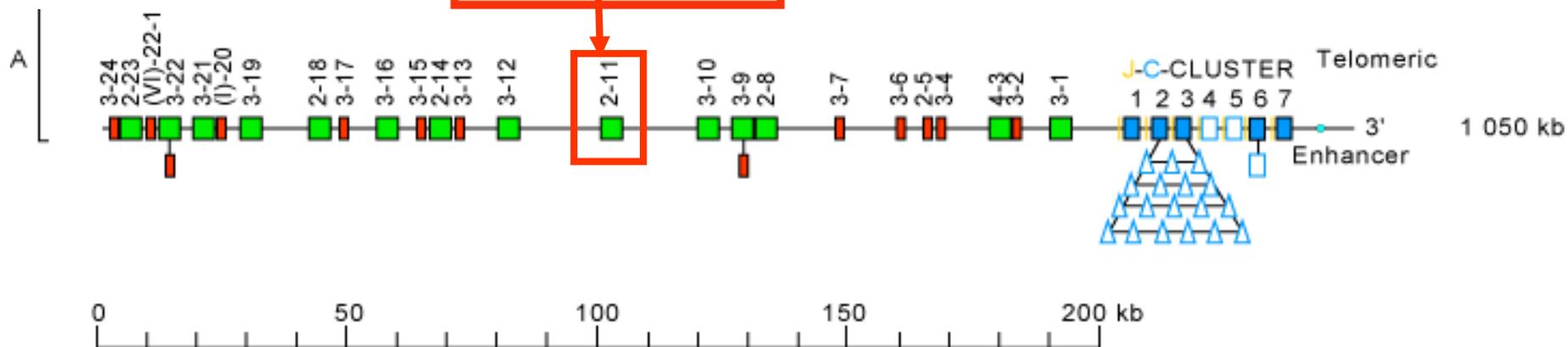
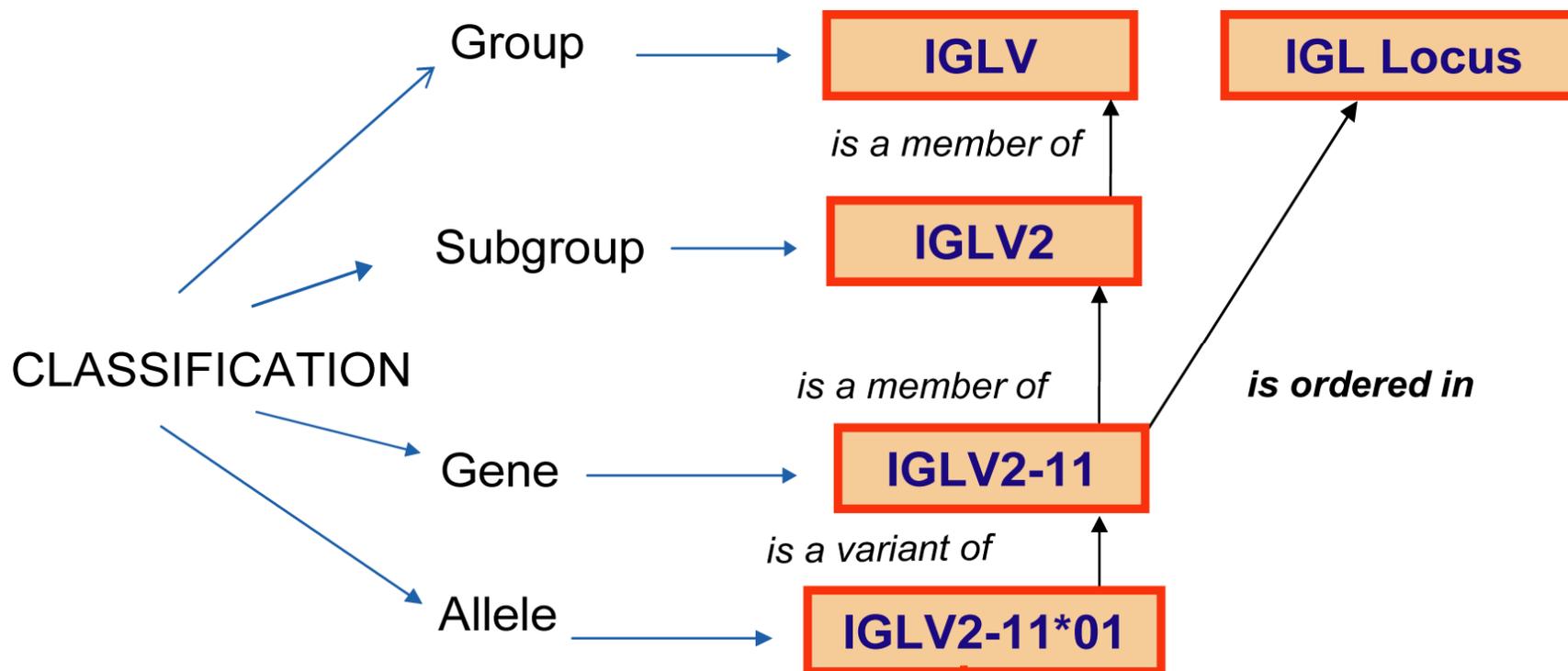
human IGLV2

human IGLV3

human IGLV4

# Concepts of CLASSIFICATION: IMGT® gene nomenclature

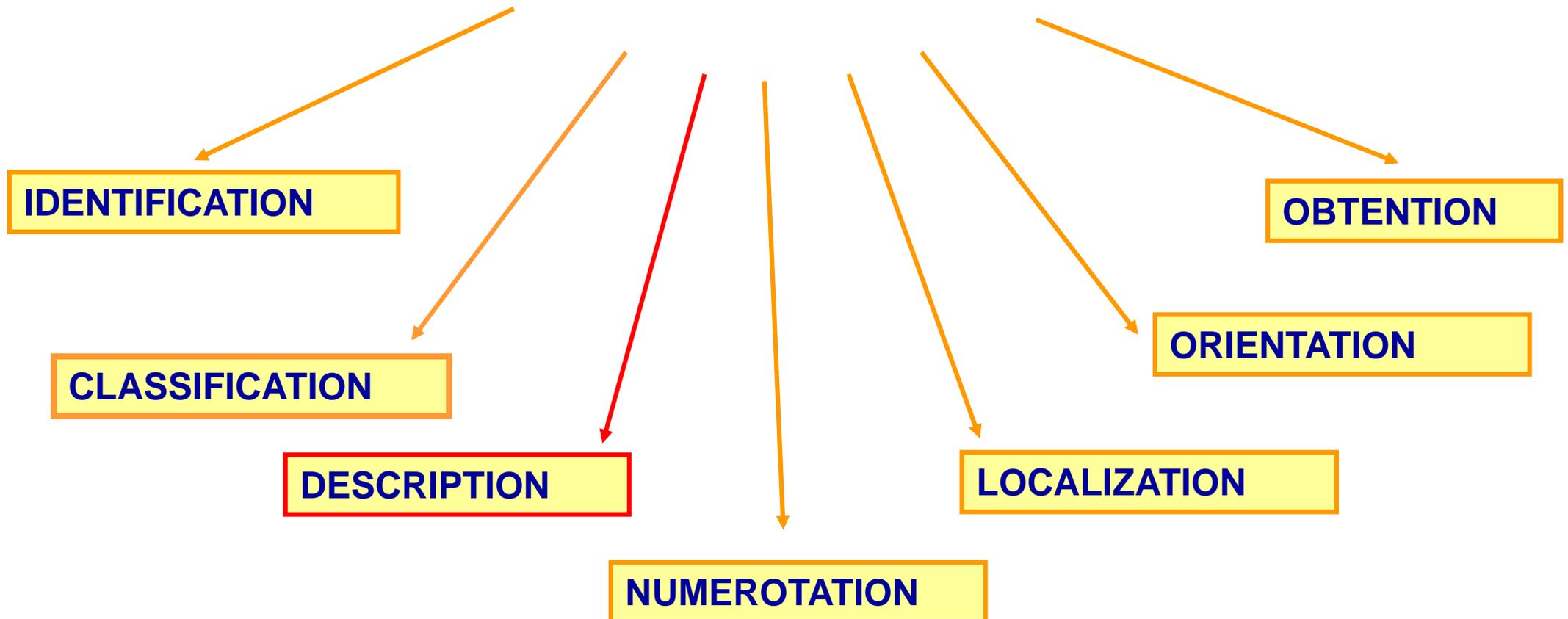
## Human IGL locus (22q11.2)



# IMGT-ONTOLOGY

Pour standardiser, partager, réutiliser et représenter  
les connaissances en immunogénétique

IMGT-ONTOLOGY repose sur 7 axiomes:



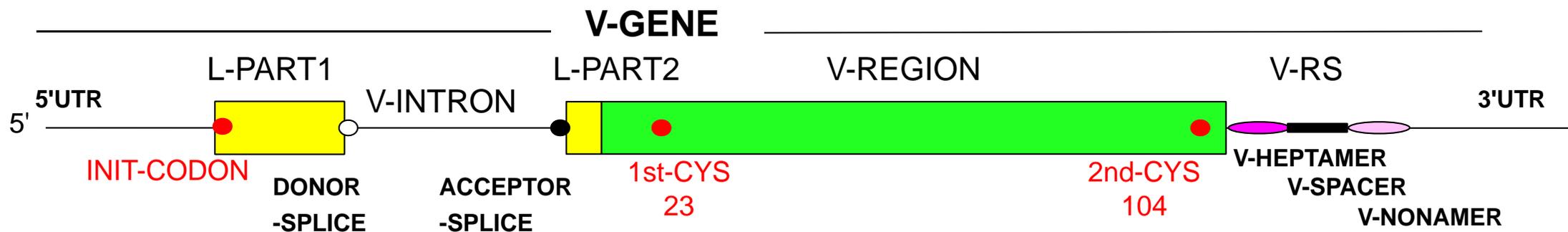
### 3- Concepts de description: décrire les motifs constitutifs

#### 1 - Description d'une entité V-gene

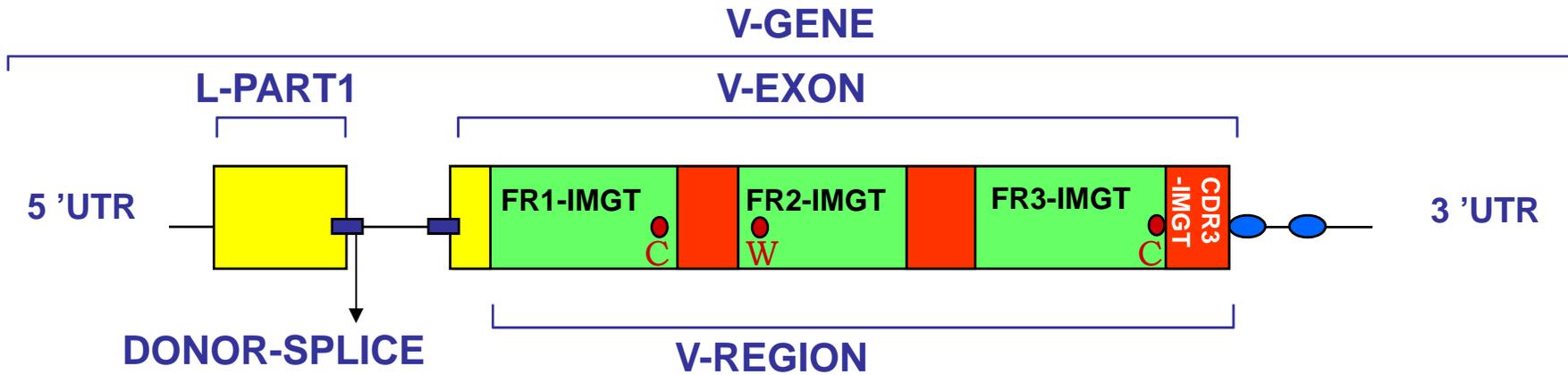
>X62106.0|HSV12|*Homo sapiens* VI-2 gene for immunoglobulin heavy chain

```

tgagagctcc gttcctcacc atggactgga cctggaggat cctcttcttg gtggcagcag      60
ccacaaggtaa gaggctccct agtcccagtg atgagaaaga gattgagtcc agtccaggga     120
gatctcatcc acttctgtgt tctctccaca ggagcccaact cccagggtgca gctgggtgcag     180
tctggggctg aggtgaagaa gcctggggcc tcagtgaagg tctcctgcaa ggcttctgga      240
tacaccttca ccggctacta tatgcactgg gtgcgacagg ccctggaca agggcttgag       300
tggatgggat ggatcaacc taacagtggg ggcacaaact atgcacagaa gtttcagggc       360
agggtcacca tgaccaggga cacgtccatc agcacagcct acatggagct gagcaggctg       420
agatctgacg acacggccgt gtattactgt gcgagagaca cagtgtgaaa tgaaa acccacaatcc
tgaggggtg c agaaacccaa gggaggaggc ag
  
```



### 3- Concepts de description: les relations



Label 1	Label 2	Label relations	
V-GENE	V-EXON		Includes/included_in
FR3-IMGT	CDR3-IMGT		Adjacent_at_its_5_prime_to/ Adjacent_at_its_3_prime_to
L-PART1	DONOR-SPLICE		Overlaps_in_5_prime/ Overlaps_in_3_prime
V-REGION	FR1-IMGT		Includes_with_same_5_prime/ included_with_same_5_prime_in
V-REGION	CDR3-IMGT		Includes_with_same_3_prime/ included_with_same_3_prime_in

# Protégé

(<http://protege.stanford.edu/>)

**Protégé est un logiciel gratuit (JAVA), plate-forme open-source qui fournit une suite d'outils pour construire des bases de connaissance et des ontologies.**

**Protégé inclut de nombreux plugins pour la manipulation et la représentation d'ontologies dans différents formats.**

**L'éditeur Protégé-OWL permet aux utilisateurs de construire des ontologies pour le Web sémantique en OWL.**

# Application: formalisation dans Protégé des labels qui composent Le V-GENE et de leur relations (Source d'information: les informations de l'article de Biochimie)

- 1- faire l'inventaire des termes (qui correspondent à autant de concepts)
- 2- les classer dans 2 catégories: codants ou non codants
- 3- créer l'arborescence des concepts
- 4- les visualiser avec OntoGraf

Relation	Reciprocal relation (inverse)
"adjacent_at_its_5_prime_to"	"adjacent_at_its_3_prime_to"
"included_with_same_5_prime_in",	"includes_with_same_5_prime",
"included_with_same_3_prime_in",	"includes_with_same_3_prime",
"overlap_at_its_5_prime_with"	"overlap_at_its_3_prime_with"
"included_in"	"includes"

- 5- créer les relations (et leurs caractéristiques)
- 6- définir les restrictions sur les relations
- 7- faire les tests de consistance





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