

Supplementary Table S1. Common data sources for biomedical KG construction

Semantic layer	Data source	Primary content	Latest update/status	Access method	Entity types	Relation types	Application domain
Molecular layer	ChEMBL ^[1]	Medicinal chemistry, bioactivity data, and compound-target associations	Active; current release ChEMBLdb 36, July 2025.	Web portal; REST API; SQL/SQLite/SDF/FASTA/RDF downloads.	Small molecules, assays, targets, target components, mechanisms, cells and tissues.	Compound-target bioactivity, assay-target, mechanism-of-action, target hierarchy and cross-reference links.	Medicinal chemistry, target discovery, DTI prediction and bioactivity annotation.
	UniProtKB ^[2]	Protein sequences, functional annotations, post-translational modification data, and associated protein-protein interaction information	Active; UniProt 2025 resource update with release-based updates.	Web portal; REST API; FTP downloads; SPARQL endpoint.	Proteins, isoforms, sequences, domains, PTMs, variants, proteomes and taxonomy records.	Protein-function, protein-gene, protein-organism, annotation, cross-reference and evidence links.	Protein annotation, target characterization, functional genomics and mechanism analysis.
	Ensembl ^[3]	High-quality cross-species reference genome sequences and annotations	Active; rolling genome releases with archived versions; latest checked release: Ensembl 115.	Genome browser; REST API; BioMart; FTP downloads; archived releases.	Genes, transcripts, proteins, exons, variants, regulatory features, genomes and species.	Gene-transcript-protein, genomic location, orthology/paralogy, variant consequence and regulatory links.	Genome annotation, variant interpretation, comparative genomics and target discovery.

NCBI Gene ^[4]	Comprehensive gene annotation, standardized gene name and ID mapping, and gene-function associations (formerly Entrez Gene)	Active/available; latest cited publication/update: 2011.	NCBI Gene web portal; E-utilities/API; FTP gene_info and gene2* files.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
PubChem ^[5]	Compound information, bioactivity data, and substance-gene associations	Active; 2025 PubChem update with continuous record-level updates.	Web portal; PUG-REST/PUG-View APIs; FTP and RDF downloads.	Compounds, substances, bioassays, targets, genes, proteins, pathways and patents/literature records.	Substance-compound, compound-assay, compound-target, bioactivity, similarity and cross-reference links.	Chemical biology, bioactivity mining, compound annotation and drug discovery.
BindingDB ^[6]	Protein-ligand binding affinity data	Active/available; latest cited publication/update: 2025.	Web portal; downloads; web services.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
Cellosaurus ^[7]	A cell line knowledgebase providing cell line origin, characteristics, contamination and misidentification records, and	Active/available; latest cited publication/update: 2018.	Cellosaurus web portal; FTP/download files; ExPASy cross-references.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.

standardized
unique identifiers

dbSNP ^[8]	Human short-sequence variation data, including SNPs and short insertions/deletions (InDels)	Active/available; latest cited publication/update: 2025.	NCBI dbSNP web portal; E-utilities; FTP/VCF downloads.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
HMDB ^[9]	Human endogenous and exogenous metabolite information, including structures, pathways, concentrations, disease associations, and spectral data	Active/available; latest cited publication/update: 2022.	HMDB web portal; XML/SDF/FASTA downloads with license terms.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
VMH ^[10]	Virtual Metabolic Human database covering metabolites, reactions, pathways, and the microbiome	Active/available; latest cited publication/update: 2019.	VMH web portal; API; model and reaction downloads.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
MiMeDB ^[11]	Microbe-metabolite association	Active/available; latest cited	MiMeDB web portal; downloadable metabolite and microbiome data files.	Genes, proteins, transcripts, variants, compounds, metabolites, structures,	Sequence/annotation links, compound-target or bioactivity	Molecular annotation, omics

	information and microbial metabolite annotations	publication/update: 2023.		cell lines or omics profiles.	records, variant mappings, cross-references and evidence links.	integration, target discovery and mechanism analysis.
TCGA ^[12]	Cancer multi-omics data, including genomic, transcriptomic, and clinical data	Legacy TCGA project; data remain accessible through GDC with harmonized data updates.	NCI Genomic Data Commons portal/API; legacy archive and harmonized downloads.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
CCLE ^[13]	Cancer Cell Line Encyclopedia, including gene expression, mutations, and drug response	Active through DepMap/CCLE release system.	DepMap portal; downloadable CCLE/DepMap release files.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
GTEX ^[14]	Normal tissue gene expression profiles, including tissue-specific expression	Active GTEx portal/resource with release-based data access.	GTEx portal; dbGaP-controlled data; public downloads for summary data.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
AlphaFoldDB ^[15]	Protein 3D structure prediction database with	Active; AlphaFold Protein Structure Database 2025/NAR 2026	Web portal; FTP/downloads; EMBL-EBI APIs.	Genes, proteins, transcripts, variants, compounds, metabolites, structures,	Sequence/annotation links, compound-target or bioactivity records, variant	Molecular annotation, omics integration,

		high-quality predicted structures across species	latest resource update identified.		cell lines or omics profiles.	mappings, cross-references and evidence links.	target discovery and mechanism analysis.
	NCBI Taxonomy ^[16]	Standardized taxonomic information providing background data for microbial and species entities	Active/available; latest cited publication/update: 2025.	NCBI Taxonomy browser; E-utilities/API; FTP taxdump downloads.	Genes, proteins, transcripts, variants, compounds, metabolites, structures, cell lines or omics profiles.	Sequence/annotation links, compound-target or bioactivity records, variant mappings, cross-references and evidence links.	Molecular annotation, omics integration, target discovery and mechanism analysis.
Interaction layer	STRING ^[17]	Protein-protein interactions, including both physical and functional interactions	Active; STRING 2025 latest resource update identified.	Web portal; API; downloadable species networks.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.
	BioGRID ^[18]	Protein-protein, gene-gene, and chemical-protein interactions	Active/available; latest cited publication/update: 2021.	Web portal; downloads; web service/API.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.
	IntAct ^[19]	Molecular interaction data, including protein-protein and	Active/available; latest cited publication/update: 2022.	Web portal; PSICQUIC/API; PSI-MI downloads.	Proteins/genes, chemicals, RNAs, microbes, regulatory	Physical, functional, causal, regulatory, host-microbe or	Network medicine, mechanism inference, DTI/interactio

	chemical-protein interactions			molecules and evidence.	chemical-protein interactions.	n prediction and target validation.
OmniPath ^[20]	Integrated signaling pathway resources and protein-protein interactions	Active/available; latest cited publication/update: 2026.	Web portal; Python/R clients; API; downloads.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.
STITCH ^[21]	Chemical-protein interactions	Available legacy chemical-protein association resource; latest major release is older and update cadence unclear.	STITCH web portal; downloadable chemical-protein networks.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.
SIGNOR ^[22]	Causal relationships in signaling pathways, such as activation and inhibition	Active/available; latest cited publication/update: 2023.	SIGNOR web portal; REST API; TSV/RDF downloads.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.
miRTarBase ^[23]	microRNA-target gene interactions	Active/available; latest cited publication/update: 2025.	miRTarBase web portal; downloadable experimentally validated miRNA-target data.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or	Network medicine, mechanism inference, DTI/interaction prediction

					chemical-protein interactions.	and target validation.
MASI ^[24]	Associations between microbes and bioactive substances, including drugs and natural products	Active/available; latest cited publication/update: 2021.	Article-associated supplementary data or repository, if available.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.
DrugVirus ^[25]	Virus-drug interaction data, including antiviral drugs and combination therapies	Active/available; latest cited publication/update: 2022.	Article-associated web resource or supplementary data, if available.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.
GIMICA ^[26]	Associations among host genetic/immune factors and the microbiome	Active/available; latest cited publication/update: 2021.	Article-associated supplementary files or repository, if available.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.
MIAOME ^[27]	Epigenetic information linking microbes, metabolites, secreted proteins, and genes	Active/available; latest cited publication/update: 2022.	Article-associated supplementary files or repository, if available.	Proteins/genes, chemicals, RNAs, microbes, regulatory molecules and evidence.	Physical, functional, causal, regulatory, host-microbe or chemical-protein interactions.	Network medicine, mechanism inference, DTI/interaction prediction and target validation.

							and target validation.
Pathway layer	KEGG ^[28]	Metabolic pathways, signaling pathways, and disease pathway associations	Active; KEGG 2025 latest resource update identified; release-note based updates.	Web portal; KEGG API; licensing applies to bulk use.	Pathways, reactions, genes/proteins, compounds, drugs and diseases.	Pathway membership, reaction, catalysis, regulation, hierarchy and disease pathway links.	Pathway enrichment, mechanistic interpretation, metabolism and drug mechanism analysis.
	Reactome ^[29]	Molecular reactions, signaling pathways, and pathway-disease associations	Active; Reactome Knowledgebase 2026 latest resource update identified.	Pathway browser; REST API; BioPAX/SBML/Neo4j/TSV downloads.	Pathways, reactions, genes/proteins, compounds, drugs and diseases.	Pathway membership, reaction, catalysis, regulation, hierarchy and disease pathway links.	Pathway enrichment, mechanistic interpretation, metabolism and drug mechanism analysis.
	WikiPathways ^[30]	Pathway resources covering metabolism, signaling, and disease pathways	Active community resource; WikiPathways 2024 latest resource update identified.	Web portal; GitHub; SPARQL/RDF; GPML/TSV downloads.	Pathways, reactions, genes/proteins, compounds, drugs and diseases.	Pathway membership, reaction, catalysis, regulation, hierarchy and disease pathway links.	Pathway enrichment, mechanistic interpretation, metabolism and drug mechanism analysis.
	Pathway Commons ^[31]	Integrated biological pathway database assembled from multiple sources	Active/available; latest cited publication/update: 2020.	Pathway Commons web portal; REST API; BioPAX downloads.	Pathways, reactions, genes/proteins, compounds, drugs and diseases.	Pathway membership, reaction, catalysis, regulation, hierarchy and	Pathway enrichment, mechanistic interpretation, metabolism and drug

						disease pathway links.	mechanism analysis.
	SMPDB ^[32]	Small Molecule Pathway Database covering metabolic, drug, and disease pathways	Available pathway database; latest major publication is older and update cadence unclear.	SMPDB web portal; pathway maps and downloadable pathway data.	Pathways, reactions, genes/proteins, compounds, drugs and diseases.	Pathway membership, reaction, catalysis, regulation, hierarchy and disease pathway links.	Pathway enrichment, mechanistic interpretation, metabolism and drug mechanism analysis.
Phenotypic layer	DO ^[33]	Standardized disease classification and definitions, plus disease-gene association annotations	Active Disease Ontology/DO-KB resource; DO-KB 2026 latest resource update identified.	Website; OBO/OWL downloads; GitHub; ontology services.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease and target prioritization.
	HMDAD ^[34]	Experimentally validated human microbe-disease associations	Static/legacy human microbe-disease dataset; accessibility.	Static dataset web page or supplementary files; verify availability before reuse.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease and target prioritization.
	Disbiome ^[35]	Associations between microbial dysbiosis and disease	Active/available; latest cited publication/update: 2018.	Disbiome web portal; downloadable microbe-disease association data if available.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease

						and target prioritization.
DisGeNET ^[36]	Disease-associated genes and variants from experimental and text-mined evidence	Active/available; latest cited publication/update: 2020.	Web platform; API/downloads subject to current access terms.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease and target prioritization.
OMIM ^[37]	Mendelian disorders and gene-disease associations	Active/available; latest cited publication/update: 2019.	Web portal; API/downloads require registration/license.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease and target prioritization.
GWAS Catalog ^[38]	Summary of genome-wide association study results covering gene/variant-disease/trait associations	Active NHGRI-EBI resource; citation corrected to GWAS Catalog 2023.	Web portal; REST API; FTP/downloads; submission system.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease and target prioritization.
HPO ^[39]	Standardized descriptions of human disease phenotypes and phenotype-disease associations	Active ontology/resource; HPO 2024 latest resource update identified.	Website; OBO/OWL downloads; GitHub; annotation files/API.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease

Clinical layer							and target prioritization.
	MONDO ^[40]	Integrated disease ontology for standardized disease classification and definition	Active/available; latest cited publication/update: 2026.	Ontology downloads; GitHub; OLS/ontology services.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease and target prioritization.
	GenCC ^[41]	Standardized annotation and evidence grading for gene-disease association validity	Active/available; latest cited publication/update: 2022.	GenCC web portal; downloadable gene-disease validity files.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease and target prioritization.
	CTD ^[42]	Chemical-gene/protein, chemical-disease, and gene-disease associations	Active; CTD 2025 update latest resource update identified.	CTD web portal; downloadable TSV/XML files; API-style query tools.	Diseases, phenotypes, genes, variants, traits, microbes and evidence records.	Gene-disease, variant-disease, disease-phenotype, ontology and microbe-disease relations.	Disease genomics, phenotype-driven discovery, rare disease and target prioritization.
Clinical layer	UMLS ^[43]	Biomedical terminology mapping, integration, and concept normalization	Active/available; latest cited publication/update: 2004.	Browser/downloads with free UMLS license; APIs.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology , safety assessment and clinical translation.

DrugBank ^[44]	Drug chemical structures, pharmacology, target information, and drug-drug interactions	Active curated drug resource; latest cited update 2024; versioned releases under DrugBank license.	Web portal; downloadable XML/CSV and API access under DrugBank license.	Approved/investigational drugs, metabolites, targets, enzymes, transporters, carriers, pathways and SNP effects.	Drug-target, drug-enzyme, drug-transporter, drug-carrier, DDI, pathway, indication and pharmacogenomic links.	Pharmacology, DTI prediction, DDI analysis, ADMET/safety and clinical translation.
CIVIC ^[45]	Clinical evidence for gene variant-disease-drug associations	Active/available; latest cited publication/update: 2017.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology, safety assessment and clinical translation.
TriCDB ^[46]	Gene-disease-treatment relationships for precision oncology	Active/available; latest cited publication/update: 2023.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology, safety assessment and clinical translation.
Open Targets Platform ^[47]	Integrated platform for target discovery including gene, disease, and drug information	Active; release 26.03 available in 2026 with regular platform releases.	Web platform; GraphQL API; data downloads via Google Cloud and release files.	Targets/genes, diseases/phenotypes, drugs, variants, studies, pathways and evidence records.	Target-disease evidence, genetic association, drug-target, pathway, safety, expression and literature evidence links.	Target identification, target prioritization, tractability, safety assessment and drug discovery.
Pharos ^[48]	Integration of druggable genome information and	Active/available; latest cited publication/update: 2017.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and	Precision medicine, pharmacology, safety assessment

	target-disease associations			annotations and evidence.	adverse-event links.	and clinical translation.
DrugCentral ^[49]	Drug information including indications, mechanisms, and approval status	Active/available; latest cited publication/update: 2019.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology , safety assessment and clinical translation.
ADReCS-Target ^[50]	Drug adverse reactions and their target associations	Active/available; latest cited publication/update: 2018.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology , safety assessment and clinical translation.
AEOLUS ^[51]	Standardized adverse drug reaction data mined from the FDA FAERS database	Static standardized FAERS-derived resource; accessibility.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology , safety assessment and clinical translation.
SIDER ^[52]	Marketed drug side effect database covering label-derived adverse reaction information	Available label-derived side-effect database; update cadence unclear.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology , safety assessment and clinical translation.
DDInter ^[53]	Drug-drug interaction database with	Active/available; latest cited	Web portal; API/downloads or controlled access	Drugs, diseases, variants, clinical concepts, adverse	Drug-target, drug-disease, variant-clinical	Precision medicine, pharmacology

	interaction severity levels and mechanism annotations	publication/update: 2022.	according to current resource terms.	events, PGx annotations and evidence.	significance, DDI, PGx and adverse-event links.	, safety assessment and clinical translation.
ClinPGx/PharmGKB ^[54]	Pharmacogenomics data on genotype-drug response relationships	Transitioned to ClinPGx in July 2025; PharmGKB URLs redirect; table label updated to ClinPGx/PharmGKB.	ClinPGx web portal; REST API/JSON/JSON-LD; CC BY-SA terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology, safety assessment and clinical translation.
Orphanet ^[55]	Rare disease information, including diseases, genes, and drugs	Active/available; latest cited publication/update: 2020.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology, safety assessment and clinical translation.
OncoKB ^[56]	Precision oncology knowledge base	Active/available; latest cited publication/update: 2017.	Web portal; API/downloads or controlled access according to current resource terms.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology, safety assessment and clinical translation.
ClinVar ^[57]	Human genetic variants and their clinical significance	Active/available; latest cited publication/update: 2018.	NCBI web portal; FTP/VCF/XML downloads; E-utilities/API.	Drugs, diseases, variants, clinical concepts, adverse events, PGx annotations and evidence.	Drug-target, drug-disease, variant-clinical significance, DDI, PGx and adverse-event links.	Precision medicine, pharmacology, safety assessment and clinical translation.

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