

MagicLamp

Web server for pathway-focused functional annotation for
microbial genomes

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Overview

MagicLamp is a modular software platform and web server for pathway-focused functional annotation of microbial genomes and metagenomes. Instead of relying on broad annotation databases, MagicLamp enables targeted interrogation of defined biological processes using curated hidden Markov models (HMMs), providing sensitive detection of remote homologs and biologically interpretable functional assignments.

The workflow integrates gene prediction, HMM-based homology searching, and automated result organization within a unified Python framework. Outputs include annotation tables and comparative visualizations describing pathway representation across datasets, supporting downstream biological interpretation and hypothesis generation.

Web Server Workflow

A lightweight web interface enables secure upload of genome assemblies, GenBank files, or accession lists corresponding to public genome records. Analyses are executed automatically, and downloadable results are delivered via email. Uploaded data are removed after processing to ensure confidentiality and responsible data handling.

MagicLamp is also available as standalone command-line software, allowing seamless integration into existing bioinformatics pipelines and high-performance computing environments.

Available Genie Modules

Genie	Biological focus	HMMs
WspGenie	Biofilm formation via the Wsp operon	8
RosGenie	ROS neutralization	12
Lucifer	Light-related reactions	19
GasGenie	Gas vesicle formation and regulation	37
CircGenie	Circadian rhythms in cyanobacteria	7
LithoGenie	Chemolithoautotrophy and respiration	177
PlasticGenie	Plastic polymer degradation pathways	50
MagnetoGenie	Magnetosome formation	10
CrisprGenie	CRISPR--Cas systems	37
SporeGenie	Sporulation genes	>100
TaxisGenie	Motility genes	>100
HazGenie	Environmental hazard resistance	68
AbxGenie	Antibiotic synthesis and resistance	26
PhageGenie	Prophage-associated genes	49
RiboGenie	Ribosome and tRNA biology	many
PGenie	Peptidoglycan biosynthesis	10

Availability

MagicLamp is freely available as both a web service and standalone open-source software with all required dependencies and curated HMM datasets included. These deployment modes enable rapid web-based screening, reproducible analysis, and scalable integration into automated bioinformatics workflows.