Lawrence Berkeley National Laboratory

Recent Work

Title

Fungal Genomics for Energy and Environment

Permalink

https://escholarship.org/uc/item/8rf747t0

Author Grigoriev, Igor V.

Publication Date 2013-03-12

Fungal Genomics for Energy and Environment

Igor V. Grigoriev¹

¹US Department of Energy Joint Genome Institute, USA

March 2013

The work conducted by the U.S. Department of Energy Joint Genome Institute is supported by the Office of Science of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor The Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or The Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or The Regents of the University of California.



Fungal Genomics for Energy and Environment

Igor V. Grigoriev ivgrigoriev@lbl.gov US Department of Energy Joint Genome Institute, Walnut Creek, CA



Genomes of fungi relevant to energy and environment are in focus of the Fungal Genomic Program at the US Department of Energy Joint Genome Institute (JGI). One of its projects, the Genomics Encyclopedia of Fungi, targets fungi related to plant health (symbionts, pathogens, and biocontrol agents) and biorefinery processes (cellulose degradation, sugar fermentation, industrial hosts) by means of genome sequencing and analysis. New chapters of the Encyclopedia can be opened with user proposals to the JGI Community Sequencing Program (CSP). Another JGI project, the 1000 fungal genomes, explores fungal diversity on genome level at scale and is open for users to nominate new species for sequencing. Over 200 fungal genomes have been sequenced by JGI to date and released through MycoCosm (www.jgi.doe.gov/fungi), a fungal web-portal, which integrates sequence and functional data with genome analysis tools for user community. Sequence analysis supported by functional genomics leads to developing parts list for complex systems ranging from ecosystems of biofuel crops to biorefineries. Recent examples of such 'parts' suggested by comparative genomics and functional analysis in these areas are presented here.

The Genomic Encyclopedia of Fungi

Symbionts



Mn-binding site Typical (3 aa

Small secreted proteins (SSP) were expanded in poplar symbiont L. bicolor and overexpressed in ECM tissue (on left; Martin et al., Nature 2008).

Comparative analysis of 15 mycorrhizal genomes shows SSP expansions in many of them (see below)





In 18 Dothideomycetes SSP are more expanded in nechrotrophs than biotrophs. Ohm et al., PLoS Path. 2012.

> Secreted peptidase Secondary metabolisr CAZymes Secreted lipases





Fungal Systems & Metagenomes



Wood Decayers



A comprehensive catalog of lignocellulolytic enzymes derived from comparative genome analysis of wood decaying fungi Floudas et al., Science 2012 Riley et al.. in prep.

Xylose Fermenters

Plant Pathogens



Comparative genomics and transcriptomics of *xylose fermenters* and xylose growers revealed candidate genes for S.cereviseae Wohlbach, et al. PNAS 2011 strain improvement.



Fungal Diversity: 1000 Fungal Genomes Project



JGIS WHome MycoCosm Repeted Step 1: Login

This project aims to provide genomic information for every family of fungi. The list below includes sequenced fungal genomes, those in progress, and selected nominations. You can log in and nominate new species for genome sequencing in the families with no (green) or only one (yellow) reference genome if you can provide DNA/RNA samples for their sequencing (see JGI User Guidelines) you know additional fungal species being sequenced somewhere but not reflected on this list, please register these projects in GOLD (use Add to GOLD link) or let us know.

Phylum name	Subphylum name	Class name	Order name	Family name		GOLD Projects		
Ascomycota	Pezizomycotina	Arthoniomycetes	Arthoniales	Arthoniaceae	None sequenced	Nominate	Add to GOLD	
Ascomycota	Pezizomycotina	Arthoniomycetes	Arthoniales	Chrysothricaceae	None sequenced	Nominate	Add to GOLD	
Ascomycota	Pezizomycotina	Arthoniomycetes	Arthoniales	Roccellaceae	None sequenced	Nominate	Add to GOLD	lominato
Ascomycota	Pezizomycotina	Arthoniomycetes	Incertae sedis	Melaspileaceae	None sequenced	Nominate	Add to GOLD	
Ascomycota	Pezizomycotina	Dothideomycetes	Acrospermales	Acrospermaceae	None sequenced * Acrospermum compressum * Oomyces carneoalbus	Nominate Manfred Binder Manfred Binder	Add to GOLD CBS KNAW CBS KNAW	new speci
Ascomycota	Pezizomycotina	Dothideomycetes	Botryosphaeriales	Bagnisiellaceae	None sequenced	Nominate	Add to GOLD	
Ascomycota	Pezizomycotina	Dothideomycetes	Botryosphaeriales	Botryosphaeriaceae	Aplosporella prunicola Botryosphaeria dothidea	Whole Genome Whole Genome	targeted Complete	
Ascomycota	Pezizomycotina	Dothideomycetes	Botryosphaeriales	Guignardiaceae	Phyllosticta citricarpa CBS 127455	Nominate	Add to GOLD	
Ascomycota	Pezizomycotina	Dothideomycetes	Botryosphaeriales	Phyllostictaceae	<u>Guignardia citricarpa</u> * Guignardia bidwellii	Whole Genome Nominate Manfred Binder	targeted Add to GOLD CBS KNAW	
					Saccharata proteae	Whole Genome	targeted	

lominate new specie for sequencing for families of Fungi with no sequenced



The work conducted by the U.S. Department of Energy Joint Genome Institute is supported by the Office of Science of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.