



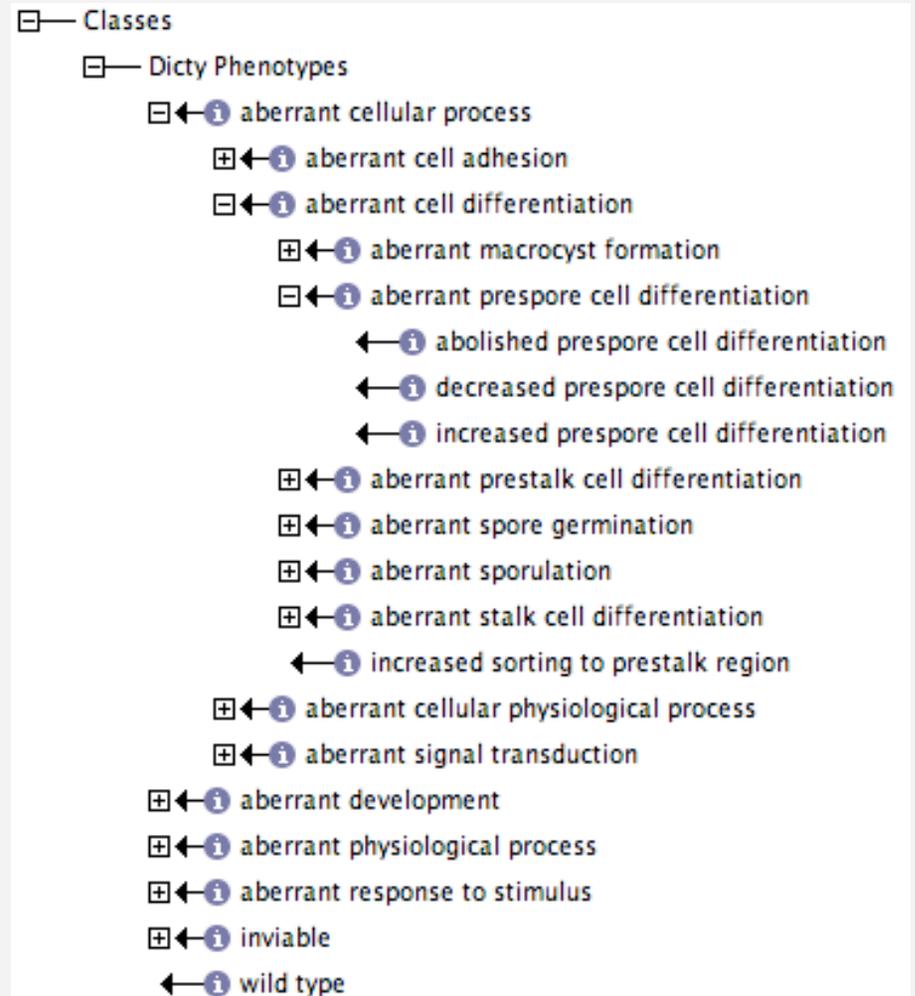
Phenotype Annotation Tool and Ontologies at dictyBase

Phenotype/PATO 2003

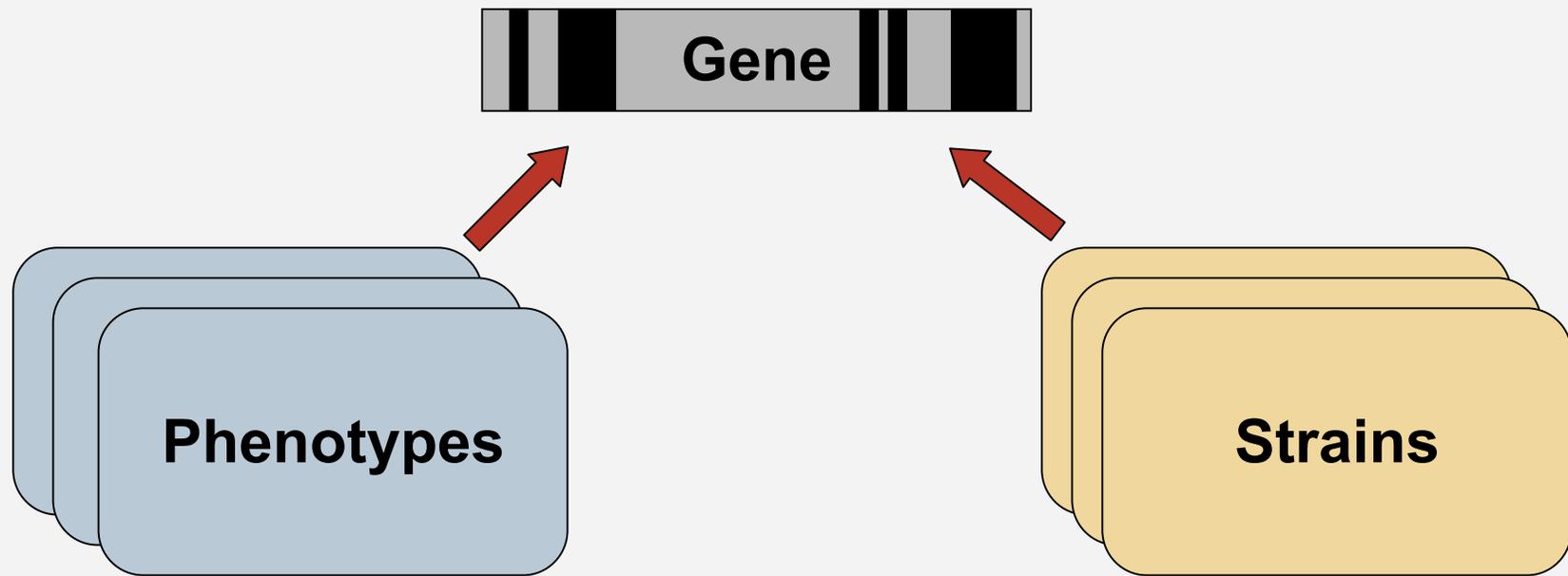
◇	A	B	C	D	E	F	G	H	I	J	K
1	locus	gen condition/mutan	environm. conditions	observable	attribute	qualifier	assay	values	unit	PMID	extra notes
2	sadA	KO/AX3	petridish HL5	substrate adhesion	ability	abolished/defective	attachment assay	<2	%WT	12499361	
3	sadA	"	petridish HL5	cytokinesis	ability	abolished/defective	DAPI staining	1-12	nuc/cell		52% have a
4	sadA	"	buffer, shaking	phagocytosis	ability	abolished/defective	uptake of latex beads	0	%WT		
5	sadA	"	suspension	vegetative growth	rate	increased	counting of cells	20	%		
6	sadA	"	petridish HL5	actin filament organization	cellular distribution	aberrant	Phalloidin staining				GO:7015
7	sadA	"	vegetative growth	cell motility	rate	increased	speed meas./cell tracking	6.3	um/min		WT 3.2
8	yeIA	KO/AX4	solid substratum	mound formation	progression	abolished/defective	observation				
9	yeIA	"	solid substratum	spore formation	progression	precocious	observation	6.00	hours	9254905	autonomou
10	yeIA	"	bacterial lawn	spore	viability	reduced	plaque formation after det	2	%WT		
11	yeIA	"	solid substratum	spore	morphology	aberrant	observation	round	rel WT		WT elongat
12	yeIA	"	solid substratum	spore coat	morphology	aberrant	electron microscopy				
13	yeIA	"	solid substratum	spore specific expression	timing/progression	precocious	spIA Northern	4	hours		
14	yeIA	"	solid substratum	prestalk specific gene expr	level	reduced	ecmA Northern				
15	yeIA	db yeIA- tacB-or tacC	solid substratum	spore formation	ability	partially rescued	plaque formation after det	15	%	9543721	tagB/C- 0%
16	mlcE	KO/JH10	suspension	cytokinesis	ability	abolished/defective	DAPI staining	>10	nuc./cell	7593282	evtl. lethal
17	mlcE	"	cAMP gradient	chemotaxis	rate	reduced	Zigmond Chamber	5.8	um/min		(by 40-50%)
18	mlcE	"	solid substratum	aggregation (loose agg)	progression	delayed	observation	2-3	hours		
19	mlcE	"	solid substratum	stalk formation	size	reduced	observation	short + thick (50%?)			
20	mlcE	"	solid substratum	mound formation	progression	abolished/defective	observation	50.00	%WT		
21	mlcE	"	growth	actin-activated ATPase activ	level	reduced	enzyme activity assay with	<10	%WT		new GO?
22	mlcE	"	high salt	MHC-MLCE binding	ability	increased	myosin solubilization in hi	<30	%		WT >80%
23	mlcE	"	growth	MHC-MLCR binding	ability	reduced	IP whole cells	56	%WT		
24	mlcE	"	growth	MHC-MLCR binding	ability	reduced	IP purified myosin	10	%WT		
25	mlcE	"	development/solid substr	prespore specific gene exp	localization	aberrant	reporter gene assay, pspA				
26	ampA	KO/AX3	starvation in buffer suspe	cell-cell adhesion	ability	increased	agglutination assay	450	%Wt	11884033	
27	ampA	"	growth in suspension	tip formation	progression	delayed	observation	4.5	hours		
28	ampA	"	growth in suspension	fruiting body formation	efficiency	reduced	observation	some	cells		
29	ampA	"	growth on bacteria 2d	mound formation	progression	delayed	observation	7-8	hours		
30	ampA	"	growth on bacteria 2d	mound formation	progression	abolished/defective	observation				
31	ampA	"	growth on bacteria 3d	mound formation	progression	abolished/defective	observation				
32	ampA	"	growth on bacteria 3d	stream formation	progression	abolished/defective	observation				
33	ampA	"	growth in suspension	substrate adhesion	ability	increased	protein retention assay af	200	%WT		
34	ampA	"	growth in suspension	substrate adhesion	ability	increased	protein retention assay af	140	%WT		
35	ampA	"	growth on bacteria 3d	substrate adhesion	ability	increased	protein retention assay af	350	%WT		
36	ampA	"	growth on bacteria 3d	substrate adhesion	ability	increased	protein retention assay af	260	%WT		
37	ampA	OE/AX3 6x	starvation in buffer suspe	cell-cell adhesion	ability	reduced	size meas. of cell clumps	50	%Wt		
38	ampA	OE/AX3 6x	growth in suspension	mound formation	progression	delayed	observation				
39	ampA	OE/AX3 6x	growth on bacteria 3d	fruiting body formation	progression	abolished/defective	observation				
40	ampA	KO/AX3	LacZ reporter gene	prespore differentiation	preference/efficiency	increased	counting of pspD cells at 1	200	%WT	11973270	

Phenotype Ontology

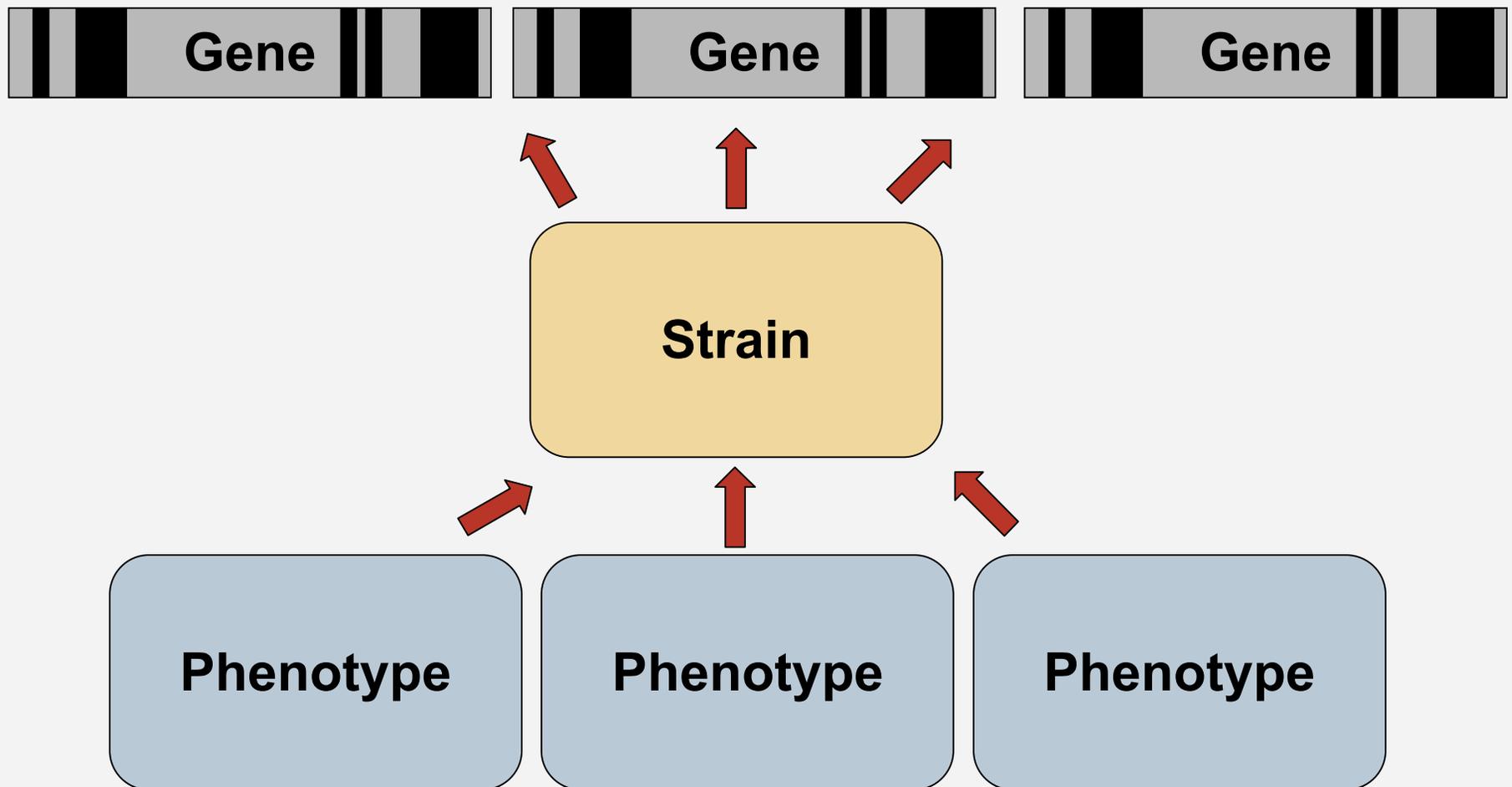
- 420 Phenotype Terms
- 1780 Phenotype Annotations
- 470 Genes with Phenotype Annotation(s)



Previous Phenotype Representation in dictyBase



New Phenotype Representation in dictyBase



Strain and Phenotype Display on the Gene Page

Cellular Component [contractile ring \(IDA\)](#), [cytoplasm \(IDA\)](#)

Expression

[UCSD Expression Profile](#) | [BCM Expression Profile](#) |



Strains and Phenotypes

[mhkB-](#) [increased myosin II assembly](#)

[mhkA-/mhkB-](#) [decreased growth rate](#), [increased myosin II assembly](#)

[mhkA-/mhkB-/mhkC-](#) [decreased growth rate](#), [increased myosin II assembly](#)

[\[act15\]:mhkB:FLAG](#) [aberrant cytokinesis](#)

Links

[mhkB Researchers](#) | [GeneDB](#) | [STKE](#) | [Entrez Nucleotide](#) | [Entrez Protein](#) | [UniProt](#) |

Community Annotations

[mhkB Community Annotations Page](#)

Phenotype and Strain Details Page

Phenotype and Strain Details for [act15]:mhkB:FLAG

Phenotype	Notes	Reference
aberrant cytokinesis	<p>mhkB activity disrupts myosin filament formation, thus overexpression mimicks the mhxA null cytokinesis defect</p> <p>Assay: nuclei count</p> <p>Environment: in suspension</p>	<p>Rico & Egelhoff (2003) 'Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton.' <i>J Cell Biochem</i> 88:521-32</p> <p>dictyBase paper PubMed Access Full Text</p>

Strain Details			
Strain Descriptor	[act15]:mhkB:FLAG	Strain ID	DBS0236665
Synonyms	MHCK-B OE	Systematic Name	DBS0236665
Description	FLAG epitope fused at the amino-terminus of mhkB overexpressed in wild type	Genotype	axeA2, axeB2, axeC2, mhkB-FLAG [pTX-MKB2], neoR
Mutant Type	overexpression	Mutagenesis Method	Extrachromosomal
Strain Type	Axenic, Drug resistant	Depositor	
Parental Strain	AX2	Species	Dictyostelium discoideum
Plasmid	pTX-MKB2	Vector	
References	12532328		
Associated Genes	mhkB		

Development of a New Phenotype Annotation Tool

- Developed in collaboration with NCBO
- Similar in functionality to Phenote
- Web-based tool that can be accessed from any computer

Features of the New Phenotype Annotation Tool

- Runs on top of the Chado database schema
- Uses terms from ontologies in .obo format for phenotype annotation
- Auto-completes ontology terms similar to Google Suggest
- Built using Web 2.0 technologies such as AJAX

Phenotype Annotation Tool

[Curator](#)
[Central](#)

Phenotype Curation

Strain	<input type="text" value="mhk"/>
Genetic Context	mhkA-/GFP-C(1-452)
Phenotype	mhkA-/GFP-C(1-498)
Quality	mhkA-/GFP-C(121-498)
Reference	mhkB-
Environment	mhkA-/mhkB-
Assay	mhkA-/mhkB-/mhkC-
Notes	<input type="text"/>

Enter Strain Name

Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
<input type="text"/>							

Phenotype Annotation Tool

[Curator](#)
[Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>		
Genetic Context	<input type="text"/>		
Phenotype	<input type="text"/>		
Quality	<input type="text"/>		
Reference	<input type="text"/>		
Environment	<input type="text"/>		
Assay	<input type="text"/>		
Notes	<input type="text"/>		

Strain	
DBS ID	DBS0235328
Strain ID	371
Strain name	mhkB-
Associated Genes	mhkB

Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes

**Retrieve Existing
Phenotype
Annotations**

Phenotype Annotation Tool

[Curator Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>	Strain	
Genetic Context	<input type="text"/>	DBS ID	DBS0235328
Phenotype	<input type="text"/>	Strain ID	371
Quality	<input type="text"/>	Strain name	mhkB-
Reference	<input type="text"/>	Associated Genes	mhkB
Environment	<input type="text"/>		
Assay	<input type="text"/>		
Notes	<input type="text"/>		

	Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
 <input type="button" value="EDIT"/> 	mhkB-	undefined	increased myosin II assembly	undefined	Rico & Egelhoff (2003) 'Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton.' J Cell Biochem 88:521-32	undefined	biochemical assay	into Triton-resistant cytoskeletal fractions

MESSAGE

Data loaded successfully

Phenotype Annotation Tool

[Curator](#)
[Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>
Genetic Context	<input type="text"/>
Phenotype	<input type="text" value="aberrant aggregation"/>
Quality	<input type="text"/>
Reference	<input type="text"/>
Environment	<input type="text"/>
Assay	<input type="text"/>
Notes	<input type="text"/>

entity

Ontology	Dicty Phenotypes
Term name	aberrant aggregation
Identifier	DDPHENO:0000483
Definition	Deviation from the normal, usual, or expected events during aggregation.
Is obsolete	0
Synonyms	
Parent terms	aberrant development
	aggregation defective
	increased number of aggregates
	delayed aggregation
	precocious aggregation
	decreased number of aggregates
	aberrant streaming
	aberrant regulation of aggregate size
	aberrant signal transduction during aggregation
	abolished chemotaxis during aggregation
	abolished chemotaxis to cAMP during aggregation
	abolished aggregation

Enter Phenotype Term

Navigate Parent and Child Terms. Click to Populate Phenotype Field

Add Update Commit Retrieve Clear All

Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
--------	-----------------	--------	---------	-----------	-------------	-------	-------

Phenotype Annotation Tool

[Curator](#)
[Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>
Genetic Context	<input type="text"/>
Phenotype	<input type="text" value="aberrant aggregation"/>
Quality	<input type="text"/>
Reference	<input type="text" value="8160"/>
Environment	<input type="text" value="Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton."/>
Assay	<input type="text"/>
Notes	<input type="text"/>

**Retrieve Reference
by ID or Author
Name**

entity	
Ontology	Dicty Phenotypes
Term name	aberrant aggregation
Identifier	DDPHENO:0000483
Definition	Deviation from the normal, usual, or expected events during aggregation.
Is obsolete	0
Synonyms	
Parent terms	aberrant development
Children terms	aggregation defective increased number of aggregates delayed aggregation precocious aggregation decreased number of aggregates aberrant streaming aberrant regulation of aggregate size aberrant signal transduction during aggregation abolished chemotaxis during aggregation abolished chemotaxis to cAMP during aggregation abolished aggregation

Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes

Phenotype Annotation Tool

[Curator Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>	Reference	
Genetic Context	<input type="text"/>	Reference no	8160
Phenotype	<input type="text" value="aberrant aggregation"/>	Pubmed ID	12532328
Quality	<input type="text"/>	Citation	Rico & Egelhoff (2003) 'Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton.' <i>J Cell Biochem</i> 88:521-32
Reference	<input type="text" value="Myosin heavy chain kinase B partici"/>	dictyBase paper PubMed Access Full Text	
Environment	<input type="text"/>		
Assay	<input type="text"/>		
Notes	<input type="text"/>		

	Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
 <input type="button" value="EDIT"/> 	mhkB-	undefined	increased myosin II assembly	undefined	Rico & Egelhoff (2003) 'Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton.' <i>J Cell Biochem</i> 88:521-32	undefined	biochemical assay	into Triton-resistant cytoskeletal fractions

Phenotype Annotation Tool

[Curator Central](#)

Phenotype Curation

Strain
Genetic Context
Phenotype
Quality
Reference
Environment
Assay
Notes

assay	
Ontology	Dictyostelium Assay
Term name	light microscopy
Identifier	DDASSAY:0000016
Definition	
Is obsolete	0
Synonymns	
Parent terms	Dictyostelium Assay
Children terms	

	Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
 <input type="button" value="EDIT"/> 	mhkB-	undefined	increase myosin I assembly		the cytoskeleton. J Cell Biochem 88:521-32	efined	biochemical assay	into Triton-resistant cytoskeletal fractions

Add Annotation To List

Phenotype Annotation Tool

[Curator Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>
Genetic Context	<input type="text"/>
Phenotype	<input type="text" value="aberrant aggregation"/>
Quality	<input type="text"/>
Reference	<input type="text" value="Myosin heavy chain kinase B partici"/>
Environment	<input type="text" value="on bacterial plates"/>
Assay	<input type="text" value="light microscopy"/>
Notes	<input type="text"/>

assay	
Ontology	Dictyostelium Assay
Term name	light microscopy
Identifier	DDASSAY:0000016
Definition	
Is obsolete	0
Synonyms	
Parent terms	Dictyostelium Assay
Children terms	

	Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
<input type="button" value="EDIT"/>	mhkB-		aberrant aggregation		Myosin heavy chain kinase B partici the regulation myos the c	on bacterial plates	light	
<input type="button" value="EDIT"/>	mhkB-	undefined	increased myosin II assembly	undefined	Rico 'Myo kinas the r myosin assembly into the cytoskeleton.' J Cell Biochem 88:521-32			into Triton-resistant cytoskeletal fractions

Commit Annotations To Database

Phenotype Annotation Tool

[Curator Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>	<table border="1"> <thead> <tr> <th colspan="2">assay</th> </tr> </thead> <tbody> <tr> <td>Ontology</td> <td>Dictyostelium Assay</td> </tr> <tr> <td>Term name</td> <td>light microscopy</td> </tr> <tr> <td>Identifier</td> <td>DDASSAY:0000016</td> </tr> <tr> <td>Definition</td> <td></td> </tr> <tr> <td>Is obsolete</td> <td>0</td> </tr> <tr> <td>Synonymns</td> <td></td> </tr> <tr> <td>Parent terms</td> <td>Dictyostelium Assay</td> </tr> <tr> <td>Children terms</td> <td></td> </tr> </tbody> </table>	assay		Ontology	Dictyostelium Assay	Term name	light microscopy	Identifier	DDASSAY:0000016	Definition		Is obsolete	0	Synonymns		Parent terms	Dictyostelium Assay	Children terms	
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Phenotype	<input type="text" value="aberrant aggregation"/>																			
Quality	<input type="text"/>																			
Reference	<input type="text" value="Myosin heavy chain kinase B partici"/>																			
Environment	<input type="text" value="on bacterial plates"/>																			
Assay	<input type="text" value="light microscopy"/>																			
Notes	<input type="text"/>																			

	Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
 <input type="button" value="EDIT"/> 	mhkB-		aberrant aggregation		Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton.	on bacterial plates	light microscopy	
 <input type="button" value="EDIT"/> 	mhkB-	undefined	increased myosin II assembly	undefined	Rico & Egelhoff (2003) 'Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton.' J Cell Biochem 88:521-32	undefined	biochemical assay	into Triton-resistant cytoskeletal fractions

MESSAGE

Successfully committed the data

Resulting Phenotype Display on the Gene Page

Cellular Component [contractile ring \(IDA\)](#), [cytoplasm \(IDA\)](#)

Expression

[UCSD Expression Profile](#) | [BCM Expression Profile](#) |

Strains and Phenotypes

[mhkB-](#) [increased myosin II assembly](#), [aberrant aggregation](#)

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Community Annotations

[mhkB Community Annotations Page](#)



Phenotype Annotation Tool

[Curator Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>	assay	
Genetic Context	<input type="text"/>	Ontology	Dictyostelium Assay
Phenotype	<input type="text" value="aberrant aggregation"/>	Term name	light microscopy
Quality	<input type="text"/>	Identifier	DDASSAY:0000016
Reference	<input type="text" value="Myosin heavy chain kinase B partici"/>	Definition	
Environment	<input type="text" value="on bacterial plates"/>	Is obsolete	0
Assay	<input type="text" value="light microscopy"/>	Synonymns	
Notes	<input type="text"/>	Parent terms	Dictyostelium Assay
		Children terms	

	Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
  	mhkB-		aberrant aggregation		Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton.	on bacterial plates	light microscopy	
  	mhkB-				Rico & Egelhoff (2003) 'Myosin heavy chain kinase B participates in the regulation of myosin assembly into the cytoskeleton.' J Cell Biochem 88:521-32	undefined	biochemical assay	into Triton-resistant cytoskeletal fractions

Edit Existing Phenotype Annotation

MESSAGE
Successfully committed the data

Phenotype Annotation Tool

[Curator Central](#)

Phenotype Curation

Strain
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assay	
Ontology	Dictyostelium Assay
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	Strain	Genetic Context	Entity	Quality	Reference	Environment	Assay	Notes
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Phenotype Annotation Tool

[Curator Central](#)

Phenotype Curation

Strain	<input type="text" value="mhkB-"/>	<table border="1"> <thead> <tr> <th colspan="2">environment</th> </tr> </thead> <tbody> <tr> <td>Ontology</td> <td>environment</td> </tr> <tr> <td>Term name</td> <td>on solid surfaces</td> </tr> <tr> <td>Identifier</td> <td>DDENVIR:0000008</td> </tr> <tr> <td>Definition</td> <td></td> </tr> <tr> <td>Is obsolete</td> <td>0</td> </tr> <tr> <td>Synonymms</td> <td></td> </tr> <tr> <td>Parent terms</td> <td>environmental condition</td> </tr> <tr> <td>Children terms</td> <td></td> </tr> </tbody> </table>	environment		Ontology	environment	Term name	on solid surfaces	Identifier	DDENVIR:0000008	Definition		Is obsolete	0	Synonymms		Parent terms	environmental condition	Children terms	
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Notes	<input type="text"/>																			

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Additional Ontologies

Assay

Classes

Dictyostelium Assay

- ← **i** agglutination assay
- ← **i** attachment to glass
- ← **i** attachment to plastic
- ← **i** biochemical assay
- ← **i** cell count
- ← **i** developmental time course
- ← **i** electron microscopy
- ← **i** germination assay
- ← **i** growth curve
- ← **i** immunofluorescence
- ← **i** light microscopy
- ← **i** measurement of surface area
- ← **i** motility assay
- ← **i** Northern blot
- ← **i** nuclei count
- ← **i** observation of a marker gene
- ← **i** phalloidin staining
- ← **i** plaque count
- ← **i** radio immune assay
- ← **i** size measurement
- ← **i** uptake of latex beads
- ← **i** uptake of yeast particles
- ← **i** viability assay

Relations

— Obsolete

Environment

Classes

environmental condition

- ← **i** at high cell density
- ← **i** at high temperature
- ← **i** at low cell density
- ← **i** at low temperature
- ← **i** in acidic medium
- ← **i** in axenic medium
- ← **i** in suspension
- ← **i** in the presence of gossypol
- ← **i** in the presence of high Ca²⁺
- ← **i** in the presence of ion chelators
- ← **i** in the presence of lithium
- ← **i** on bacterial plates
- ← **i** on solid surfaces

Relations

— Obsolete

Future Directions

- Dissection of Dicty phenotype ontology terms to fit PATO Entity-Quality model
- Collaboration with other groups on PATO and phenotype-related ontologies (e.g., genetic context, environmental conditions)
- Provide phenotype annotation tool to GMOD as open-source software

Acknowledgements

Principal Investigators

- Rex Chisholm
- Warren Kibbe

Software Developers

- Eric Just
- Sohel Merchant

Curators

- Petra Fey
- Pascale Gaudet
- Karen Pilcher

Funding

- NIH
- GO Consortium