



The KNIME Image Processing Plugin

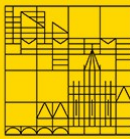


Image Processing with KNIME – The Current State

Available Image Processing Nodes

The Image Data Model (ImgLib)

Biological Image Processing with JAVA – An Outlook



Image Processing Nodes

Contributors: Martin Horn, Christian Dietz, Felix Schönberger



Image Reader



Image Writer



OMERO DB Reader



I/O





Image Reader



Im



Image Writer



OMERO DB Reader



I/O

File browser

Path: nm/cell_images/ExampleSBSImages

bin
cell_images
bbbc image sets
bioformats_test-sa
ETAR
ExampleSBSImage
human_ht29_color
human_rbc_dic_im
human_rbc_dic_ou
intensitymeasure
Norak
Phos

Channel1-01-A-01.t
Channel1-02-A-02.t
Channel1-03-A-03.t
Channel1-04-A-04.t
Channel1-05-A-05.t
Channel1-06-A-06.t
Channel1-07-A-07.t
Channel1-08-A-08.t
Channel1-09-A-09.t
Channel1-10-A-10.t
Channel1-11-A-11.t
Channel1-12-A-12.t
Channel1-13-B-01.t

Selection

add >>
add all >>
remove
remove all

Selected files (97)

Channel1-01-A-01.t
Channel1-02-A-02.t
Channel1-03-A-03.t
Channel1-04-A-04.t
Channel1-05-A-05.t
Channel1-06-A-06.t
Channel1-07-A-07.t
Channel1-08-A-08.t
Channel1-09-A-09.t
Channel1-10-A-10.t
Channel1-11-A-11.t
Channel1-12-A-12.t
Channel1-13-B-01.t
Channel1-14-B-02.t
Channel1-15-B-03.t
Channel1-16-B-04.t
Channel1-17-B-05.t

Image Metadata



In: 106 formats
Out: 10 formats



Image Reader



Im



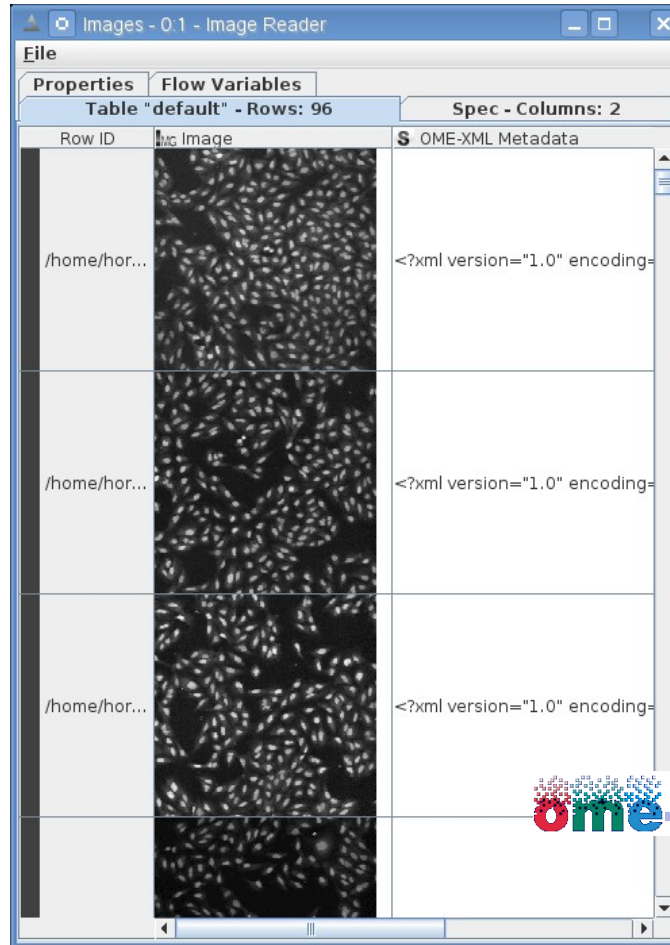
Image Writer



OMERO DB Reader



I/O





OMERO DB Reader

Image Importer



Image Writer

OMERO DB Reader



I/O

Dialog - 0.3 - OMERO DB Reader

File

Flow Variables Memory Policy

Options

User name

Password

Host

Port

OK Apply Cancel



Image Reader




Image Writer




OMERO DB Reader






...



I/O

ImageJ Macro



Binary global
Thresholder



Projector



Inverter



Converter





Contrast Enhancer

Binary Arithmetic

Binary Operations

...

Processing





Image Reader



Image Writer


OMERO DB Reader









...




I/O

ImageJ Macro

**Binary global
Thresholder**









Projector

Inverter

Converter

Contrast Enhancer

Binary Arithmetic

Binary Operations


...

Processing

Image Annotator



**Connected Component
Analysis**

**Voronoi
Segmentation**


...

Segmentation





Voronoi Segmentation

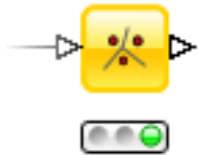


Image Writer

OMERO DB Reader

I/O

ImageJ Macro



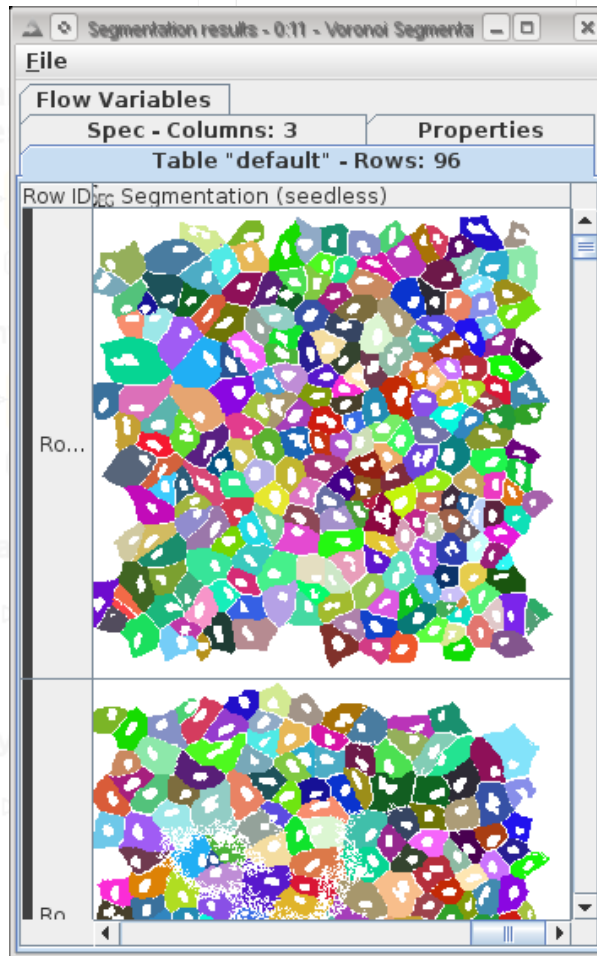
Projector

Converter

Binary Arithmetic



Processing



Segmentation



Image Reader



Image Writer



OMERO DB Reader




...


I/O

ImageJ Macro


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Image Annotator



Connected Component
Analysis




Voronoi
Segmentation




...

Segmentation


Histogram Features




Segment Features



Texture Features

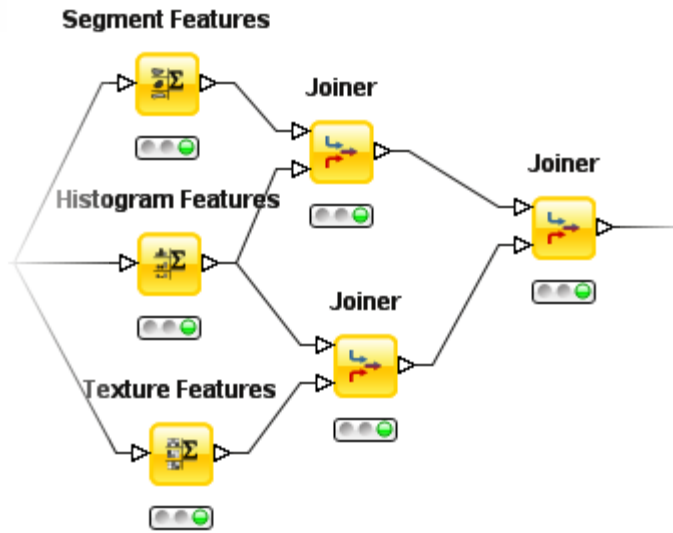


Zernike Features



...

Feature Calc.



Joined table - 0.30 - Joiner

File

Table "default" - Rows: 14370 Spec - Columns: 35 Properties Flow Variables

Row ID	Segme...	Segme...	D Num Pix	D Min	D Max	D Mean	D Sum	D Squar...	D Std Dev	D Variance	D Skewn...
Ro...	1	1,513	-124	-35	-105.318	-195,680	21,484,278	21.716	471.589	1.507	
Ro...	2	1,326	-123	17	-100.816	-158,685	17,447,855	30.359	921.682	2.038	
Ro...	3	783	-123	-12	-101.436	-98,799	10,762,363	27.588	761.103	1.582	
Ro...	4	694	-125	-17	-99.006	-91,878	10,092,478	32.778	1,074.393	1.281	
Ro...	5	927	-122	44	-91.601	-104,975	11,923,823	44.897	2,015.707	1.793	
Ro...	6	704	-125	-48	-106.156	-89,914	9,904,684	20.622	425.281	1.53	
Ro...	7	1,268	-124	14	-105.557	-156,224	17,955,168	31.469	990.311	2.179	
Ro...	8	1,004	-124	-30	-108.951	-123,332	14,026,694	22.832	521.315	2.174	
Ro...	9	1,349	-124	-23	-105.201	-168,638	18,848,958	26.299	691.628	1.762	
Ro...	10	1,208	-124	-8	-105.519	-149,943	16,959,097	28.299	800.851	2.013	
Ro...	11	873	-125	-48	-109.474	-112,101	12,669,227	19.703	388.195	1.771	
Ro...	12	1,669	-124	-41	-109.201	-209,229	23,591,947	19.71	388.482	1.942	
Ro...	13	2	-86	-79	-82.333	-247	20,361	3.512	12.333	-0.423	
Ro...	14	2,725	-124	-24	-114.236	-333,682	39,137,486	18.682	349.022	3.245	
Ro...	15	1,706	-125	-34	-109.541	-218,754	25,060,570	23.454	550.085	1.904	
Ro...	17	1,148	-124	-49	-110.179	-145,326	16,503,628	19.316	373.115	1.877	
Ro...	16	1,351	-123	14	-103.217	-163,806	18,454,018	31.225	975.025	2.14	
Ro...	19	1,445	-123	-28	-109.381	-180,370	20,574,318	22.646	512.856	2.21	
Ro...	18	2,161	-124	-27	-115.289	-267,010	31,549,490	18.191	330.927	3.291	
Ro...	21	974	-124	-55	-110.908	-123,551	14,005,071	16.481	271.638	1.841	
Ro...	20	730	-123	-33	-105.077	-93,729	10,403,017	24.94	622.022	1.582	
Ro...	23	1,234	-124	-46	-112.105	-157,171	18,067,109	17.872	319.399	2.11	
Ro...	22	1,890	-125	-26	-112.705	-233,300	27,158,322	20.437	417.676	2.768	
Ro...	25	1,538	-124	-11	-107.475	-188,511	21,531,507	26.93	725.216	2.324	
Ro...	24	832	-124	-51	-109.718	-105,549	11,957,245	19.796	391.872	1.848	
Ro...	27	1,586	-125	-49	-115.298	-199,927	23,477,945	15.692	246.238	2.51	
Ro...	26	1,154	-124	-47	-103.725	-152,476	16,452,178	20.817	433.342	1.296	

I/O

Processing

Segmentation

Feature Calc.



Image Reader



Image Writer



OMERO DB Reader




...


I/O

ImageJ Macro


Binary global
Thresholder




Projector




Inverter




Converter




Contrast Enhancer



Binary Arithmetic




Binary Operations




...

Processing


Image Annotator



Connected Component
Analysis




Voronoi
Segmentation




...

Segmentation


Histogram Features




Segment Features



Texture Features




Zernike Features




...

Feature Calc.

Table Cell Viewer



Segment Viewer



...

Views



Table Cell Viewer



Table Cell View - 0.20 - Table Cell Viewer

File

Row ID	Image
/home/hor...	

Image View Histogram

X[125/400]; Y[300/300]; Z[1/21]; C[1/2]; T[1/19]; value=-111.0; type=ByteType

Minimap

Plane Selection

- N
- X
- Y
- Z
- C
- T

Image Enhance Contrast

RGB M: none

prop	value
Type	mpicbg.i...
Container	mpicbg.i...
SizeX	400
SizeY	300
SizeZ	21
SizeC	2
SizeT	19

I/O

Processing

Segmentation

Feature Calc.

Views



Segment Viewer



ImageJ Macro

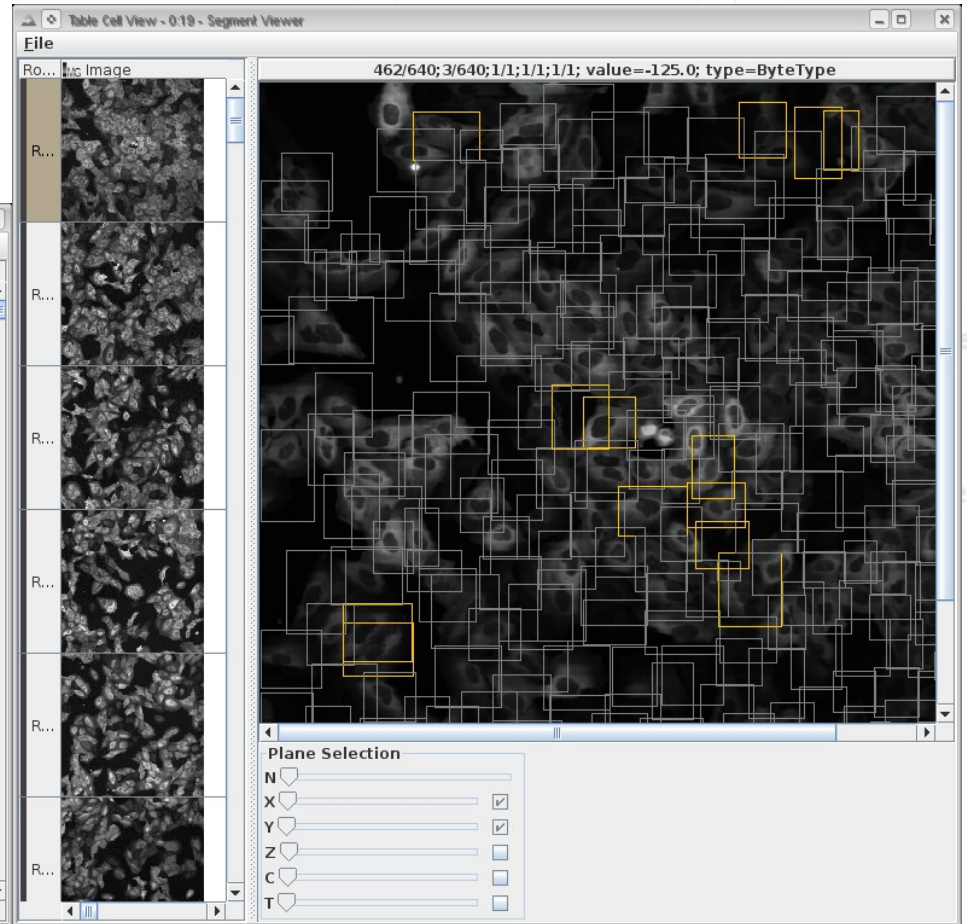
Binary global
Thresholder

Image Writer

OMERO DB Reader

Binary

Row ID	Segme...	Sub-image Info
Row1_1		Image: Row1, Offse
Row1_2		Image: Row1, Offse
Row1_3		Image: Row1, Offse
Row1_4		Image: Row1, Offse
Row1_5		Image: Row1, Offse
Row1_6		Image: Row1, Offse
Row1_7		Image: Row1, Offse
Row1_8		Image: Row1, Offse
Row1_9		Image: Row1, Offse
Row1_10		Image: Row1, Offse



I/O

Processing

Segmentation

Feature Calc.

Views



Image Data Structure



ImgLib – Generic Image Processing in Java

Stephan Preibisch & Stephan Saalfeld
Tomancak Group



CBG

Max Planck Institute
of Molecular Cell Biology
and Genetics



ImgLib

Why?

- Generic programming – Write it once!
- More algorithm-like programming
- Easier to understand code
- Smaller source code
- Easier exchange of code
- ...



ImgLib

How?

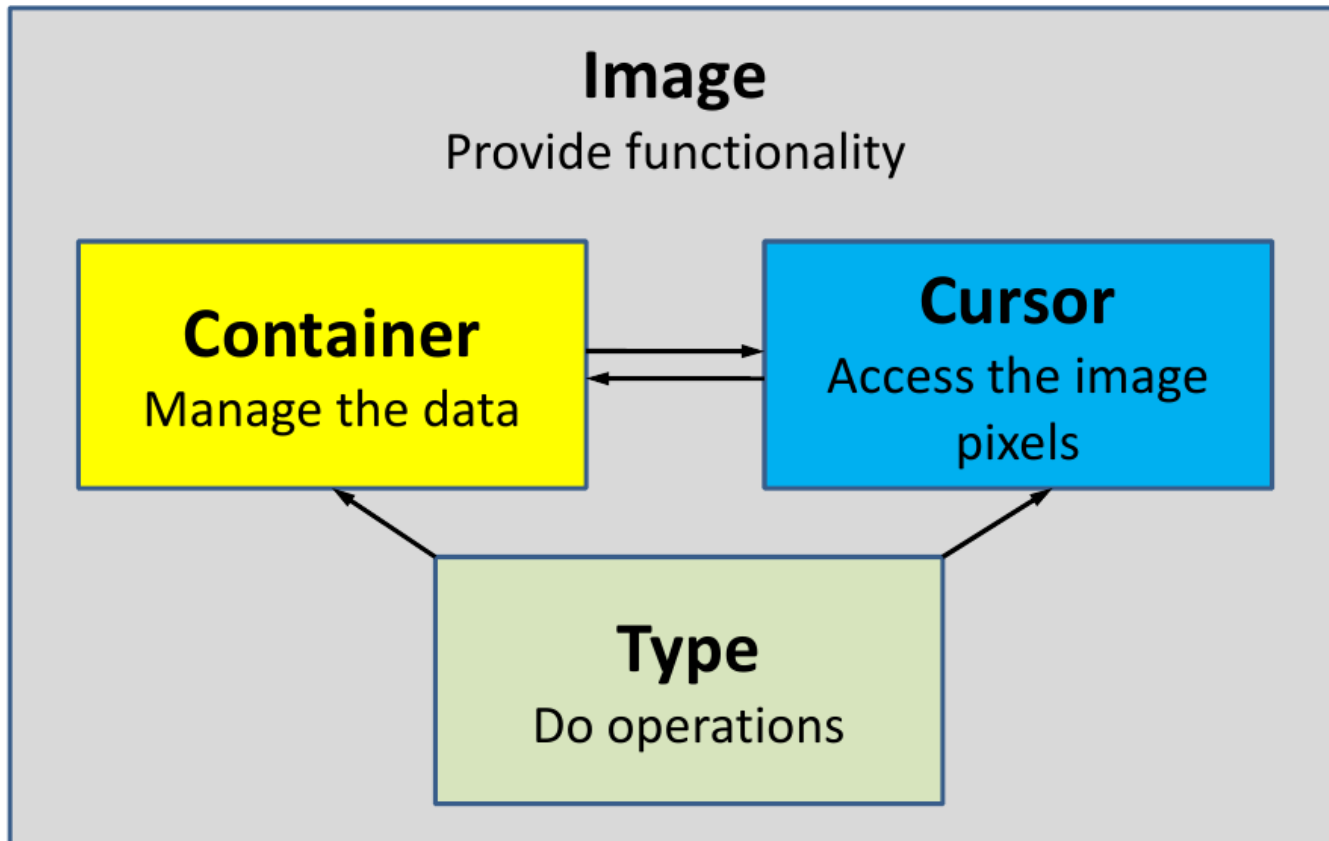
Abstract implementation of algorithm independent from the ...

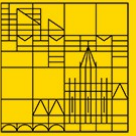
- ... Dimensions (if possible):
 - 2d, 3d, ...
- ... Storage
 - in memory (as one or multiple arrays, planes, sparse ...)
 - paged on disc
 - distributed over the net
- ... Type
 - 8 bit, 16 bit, float, complex, labels



ImgLib

How?





ImgLib

Example!

```
public static <T extends Type<T>> void fill(Image<T> img, T val) {
    Cursor<T> c = img.createCursor();
    while (c.hasNext()) {
        c.fwd();
        c.getType().set(val);
    }
    c.close();
}

public static void main(String[] args) {
    Image<ByteType> img = new ImageFactory<ByteType>(new ByteType(),
        new ArrayContainerFactory()).createImage(new int[]
        { 500, 500, 10 });
    fill(img, new ByteType((byte) 10));
}
```



Biological Image Processing with JAVA - An Outlook



The next generation of ImageJ

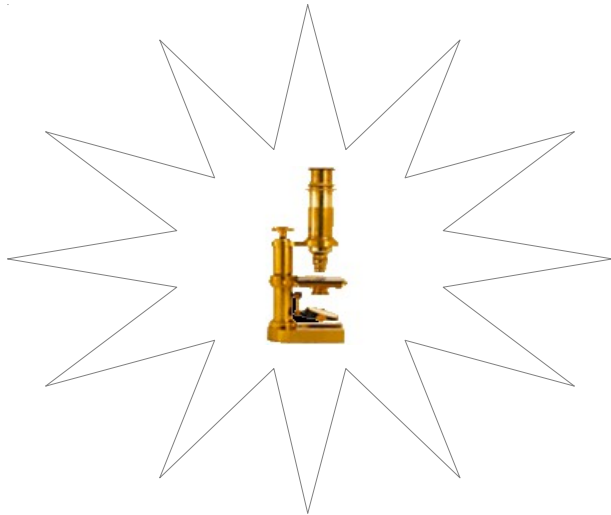


ImageJX

<http://www.imagejdev.org>



The next generation of ImageJ



National Institutes of Health

Wayne Rasband (ImageJ)





The next generation of ImageJ

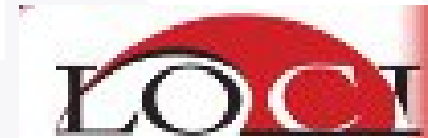


Laboratory for Optical and Computation (LOCI) at UW-Madison

Bioformats

OME / OMERO

VisBIO





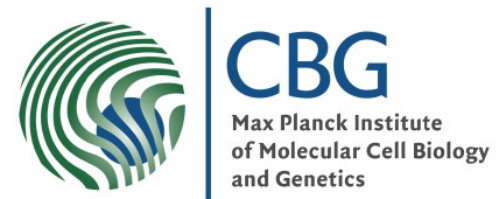
The next generation of ImageJ



**Max Planck Institute of Molecular Cell
Biology and Genetics (MPI-CBG) at
Dresden**

Fiji (Fiji is just ImageJ)

ImgLib2





The next generation of ImageJ



Broad Institute of MIT and Harvard

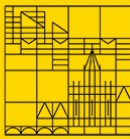
Cell Profiler





The next generation of ImageJ





The next generation of ImageJ

Aims:

- Improve the ImageJ core architecture
 - separate the data model from the user interface
 - extension framework for algorithms
 - broaden the image data model



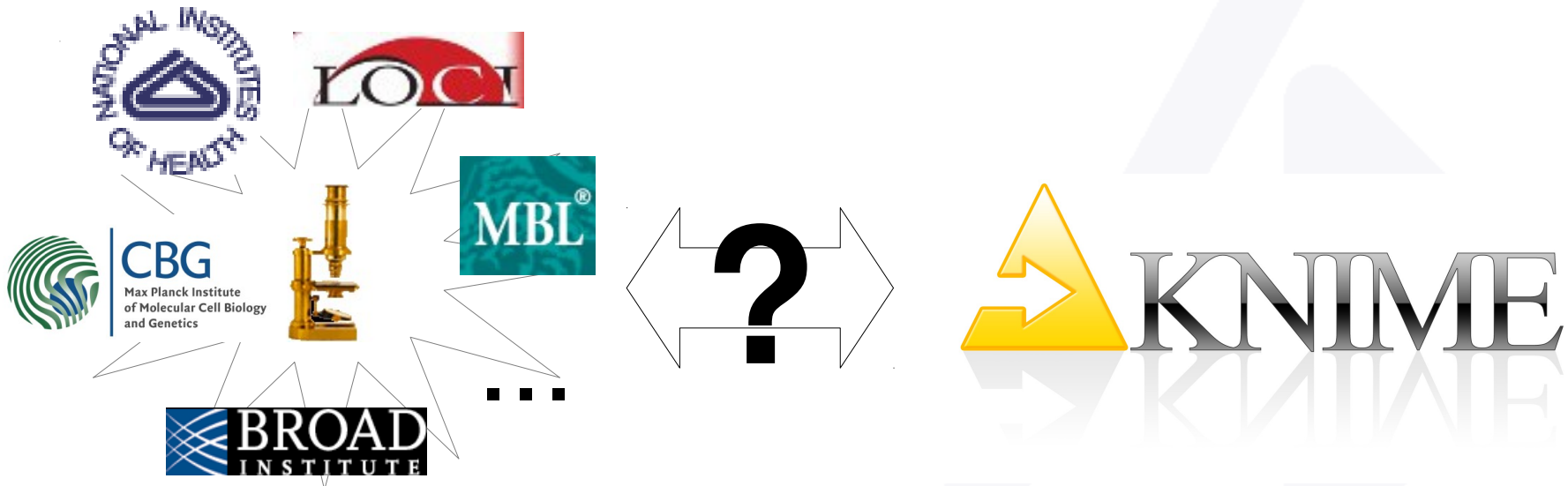
ImageJX

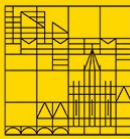
- Interfacing ImageJ with existing open-source programs
 - e.g. CellProfiler, VisBio

...



The next generation of ImageJ





Resources

<http://tech.knime.org/community-image>

- KNIME Image Processing Plugin

<http://pacific.mpi-cbg.de/wiki/index.php/Imglib>

- ImgLib

<http://imagejdev.org/>

- next generation of ImageJ

<http://www.openmicroscopy.org>

- BioFormats, OME-XML, Omero