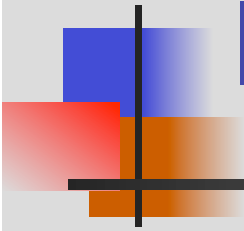
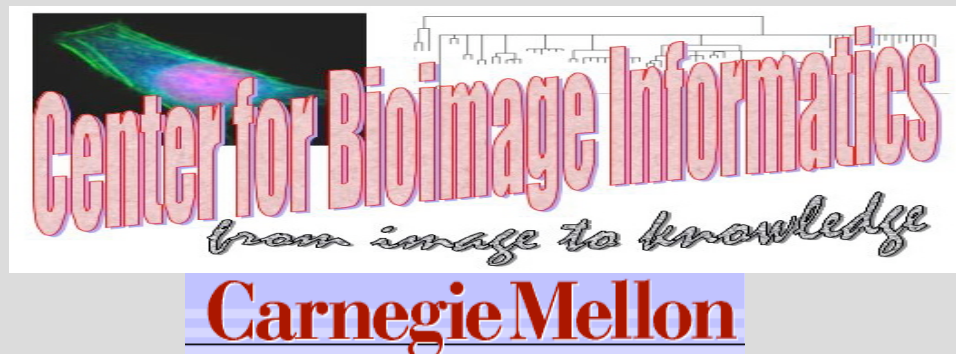
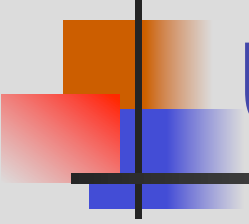


# The Subcellular Location Image Finder (SLIF)



<http://slif.cbi.cmu.edu>

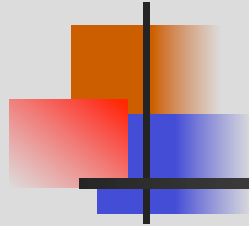




# Ultimate Goal of the field

---

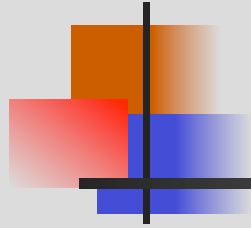
- Machine understanding of biological journal articles (text and image)
- Criteria for success: Turing test - have machine be able to answer questions about an article as well as a human scientist



# Intermediate Goal

---

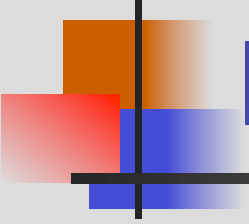
- Extract information from combination of text and any kind of image in biological journal article
- Criteria for success: Achieve high precision and recall for extracted assertions (compared to expert scientist)



## Immediate Goal (SLIF)

---

- Extract information about subcellular location from captions and figures containing fluorescence microscope images in biological journal articles
- Criteria for success: Achieve high precision and recall for extracted assertions (compared to expert scientist)

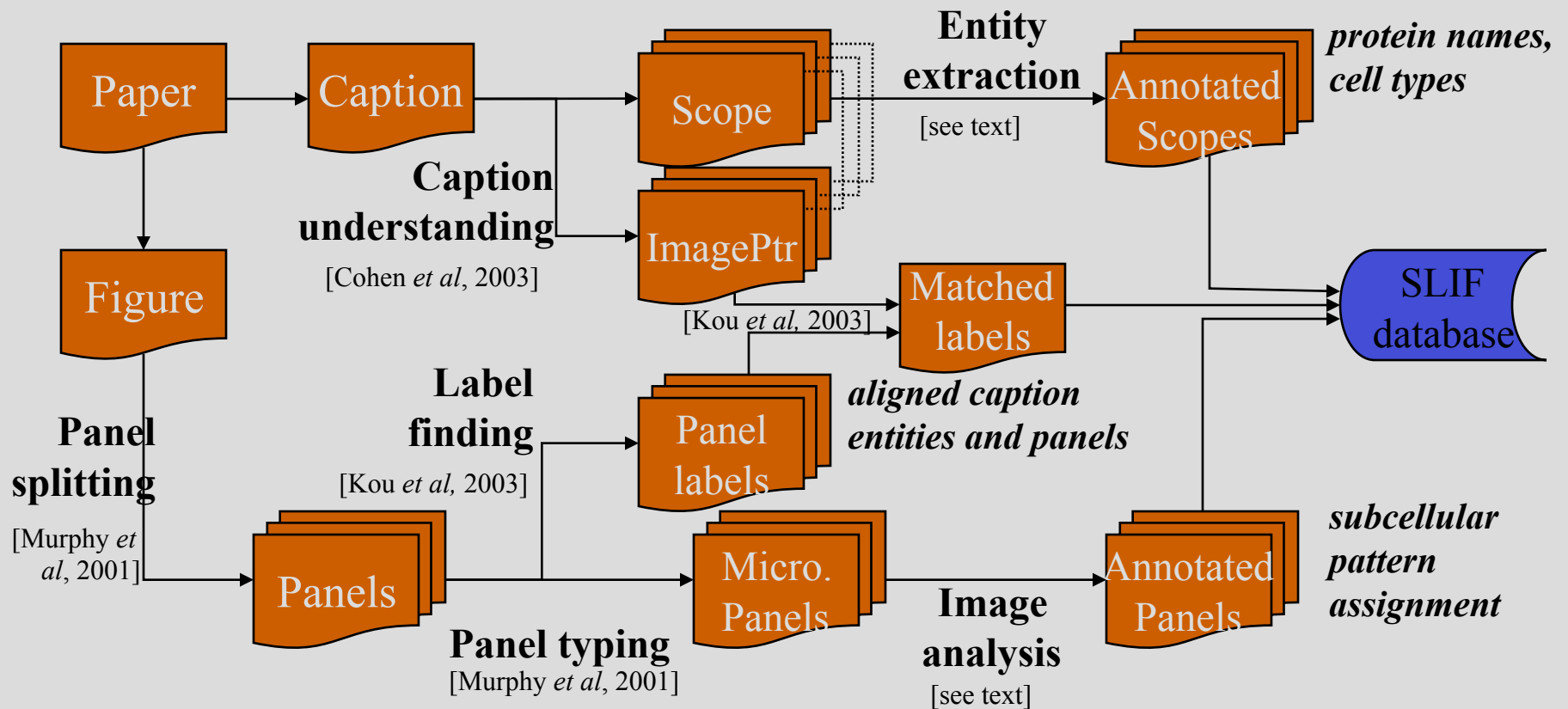


# State of art: Bio Journal Information Extraction

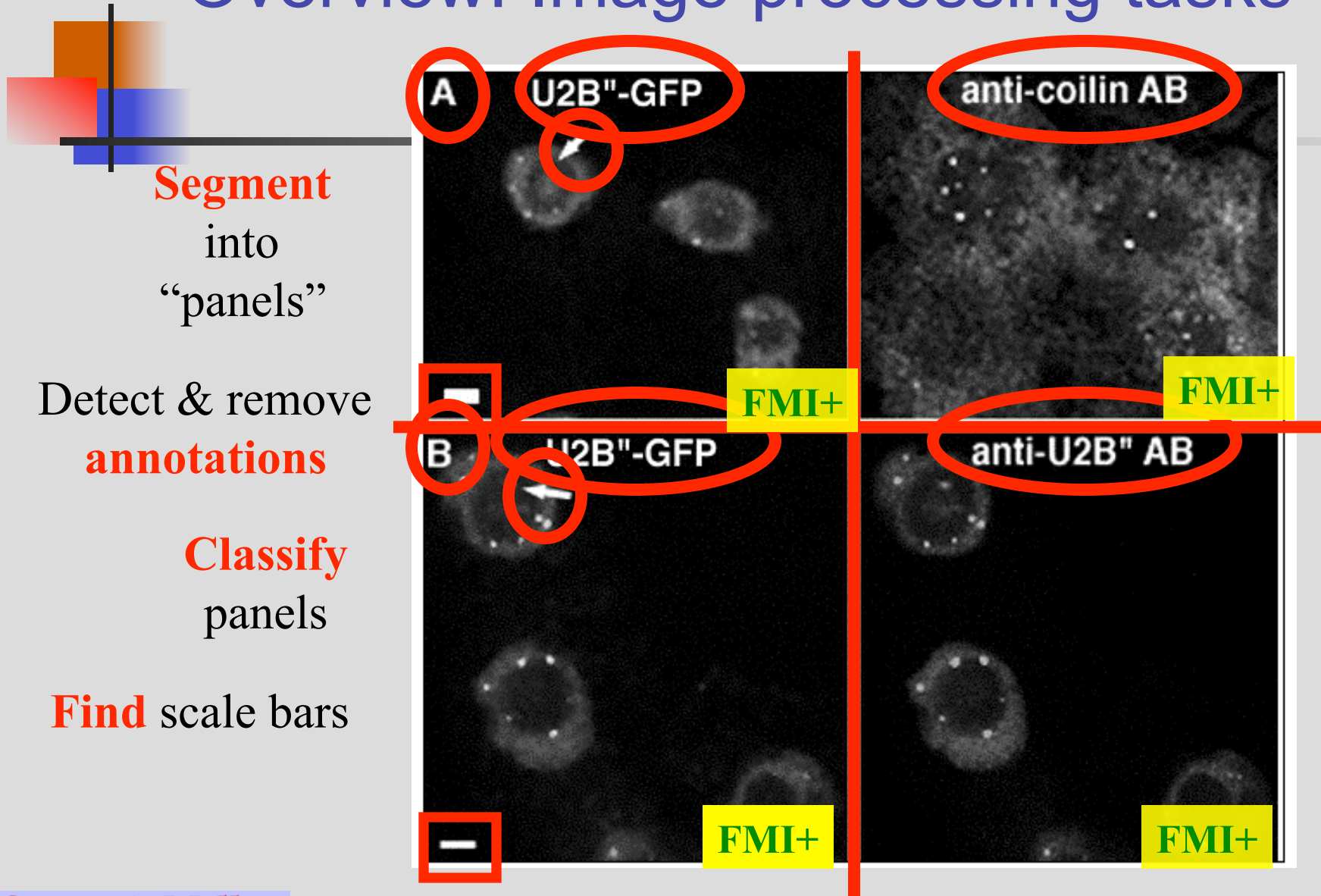
---

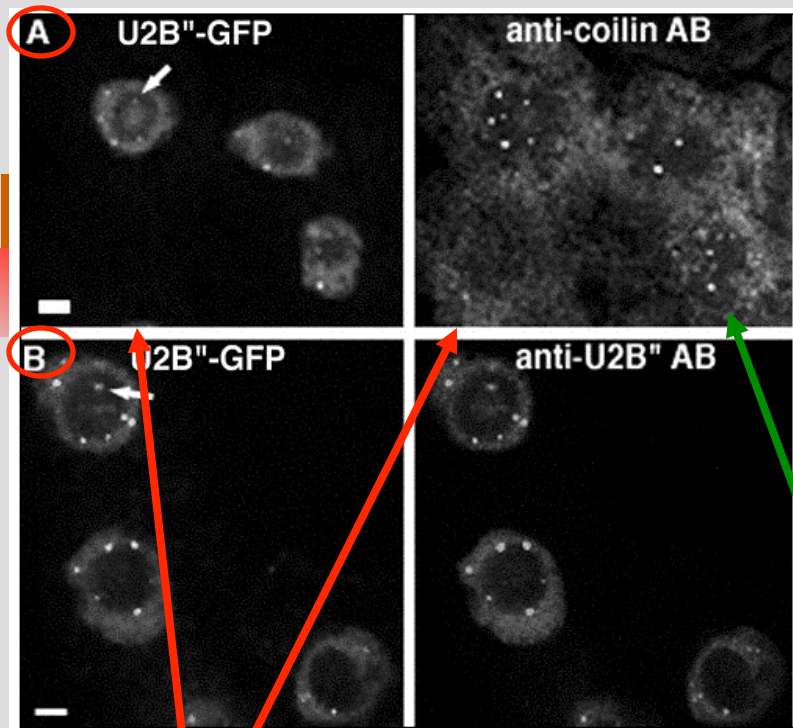
- A number of systems to index literature via extracted terms
- A few systems to index image content in literature
- A few systems for document classification

# SLIF Pipeline components



# Overview: Image processing tasks





## Overview: Text processing tasks

- Find *entity names* in text, and *panel labels* in text and the image.
- *Match* panels labels in text to panel labels on the image.
- *Associate* entity names to textual panel labels using *scoping* rules.

Figure 1. (A) Single confocal optical section of BY-2 cells expressing U2B''-GFP, double labeled with GFP (left panel) and autoantibody against p80 coilin (right panel). Three nuclei are shown, and the bright GFP spots colocalize with bright foci of anti-coilin labeling. There is some labeling of the cytoplasm by anti-p80 coilin. (B) Single confocal optical section of BY-2 cells expressing U2B''-GFP, double labeled with GFP (left panel) and 4G3 antibody (right panel). Three nuclei are shown. Most coiled bodies are in the nucleoplasm, but occasionally are seen in the nucleolus (arrows). All coiled bodies that contain U2B'' also express the U2B''-GFP fusion. Bars, 5  $\mu$ m. Movement of Coiled Bodies Vol. 10, July 1999 2299



<http://slif.cbi.cmu.edu>

WELCOME TO

SLIF

## Subcellular Location Image Finder

SLIF (Subcellular Location Image Finder) automatically extracts information about protein subcellular locations from figure-caption pairs in biological literature. SLIF separates figures into panels and decides which panels contain fluorescence microscope images (FMI). It applies image processing methods to analyze the FMI and extract a quantitative description of the localization patterns they display. The associated captions are also processed to identify which portions of the caption refer to which panels and to identify the names of proteins contained in the captions. The results of this analysis are stored in the SLIF database.

Our long-term goal is to develop a large library of annotated and analyzed fluorescence microscope images, in order to support data-mining.

### PNAS, version 3.0

The current version of the database contains records for 15180 papers from volumes 94-99 of the Proceedings of the National Academy of Sciences (USA), generously made available by the Academy for demonstration purposes.

### Pubmed Central, version 1.1

This database includes all open access articles in Pubmed Central (approximately 42,000 articles through 30 April 2007).

A service of the Robert F. Murphy laboratory  
Departments of [Biological Sciences](#), [Biomedical Engineering](#), and [Machine Learning](#)  
and [Center for Bioimage Informatics](#)  
[Carnegie Mellon University](#), Pittsburgh, Pennsylvania, U.S.A.

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http://slif.cbi.cmu.edu/PMC/

# SLIF

## Subcellular Location Image Finder

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[Search by locations inferred from Images](#)  
[Browse by combination of locations inferred from GO Terms and Images](#)  
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SLIF (Subcellular Location Image Finder) automatically extracts information about protein subcellular locations from *figure-caption* pairs in biological literature. SLIF separates *figures* into *panels* and decides which panels contain *fluorescence microscope images (FMI)*. It applies image processing methods to analyze the FMI and extract a quantitative description of the localization patterns they display. The associated captions are also processed to identify which portions of the caption refer to which panels and to identify the names of *proteins* contained in the captions. The results of this analysis are stored in the SLIF database, which can be queried either interactively (using the links at the left) or via [external program-generated links](#).

Our long-term goal is to develop a large library of annotated and analyzed fluorescence microscope images, in order to support data-mining and integration with other databases.

[Acknowledgments](#) [People](#) [Reference](#)

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SLIF Database pmc

|                                                        |                |
|--------------------------------------------------------|----------------|
| Source                                                 | Pubmed Central |
| Number Of Articles                                     | 41981          |
| Total Captions                                         | 81614          |
| Total Figures                                          | 81617          |
| Total Panels                                           | 264752         |
| FMI Panels                                             | 37026          |
| Total Proteins                                         | 45956          |
| Total Cell Types                                       | 0              |
| Number of Subcellular Locations Inferred from GO Terms | 21             |
| Number of Subcellular Locations Inferred from Images   | 10             |

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# SLIF

## Subcellular Location Image Finder

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[Search for FMI figures/panels](#)

[Search by location inferred from GO terms](#)

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Search by words in caption

Number of records displayed per page: 

10

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[http://slif.cbi.cmu.edu/PMC/caption\\_search.do](http://slif.cbi.cmu.edu/PMC/caption_search.do)

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[Search by location inferred from GO terms](#)  
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Searched for:

**Captions** with the word(s) **actin**.

Results 1 - 10 of 36550

Next 10 Results

| Caption                                                                                                                                                                                                                         | Figure | Panel | Protein<br>↓         | Cell Type<br>↑↓ | Location Inferred from Image<br>↓ | Location Inferred from GO Terms<br>↓ | Resolution (μm/pixel)<br>↑↓ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|----------------------|-----------------|-----------------------------------|--------------------------------------|-----------------------------|
| Prevention of apoptosis in MCF-7 cells by Bcl-2 and Bcl-XL and by mutants with restricted subcellular localization. A) Cell lysates containing 20 μg of protein from vector control (neo) or transfected MCF-7 cells expressing |        |       | <a href="#">Bcl2</a> | N/A             | Endosome                          | N/A                                  | 0.057576                    |
| Morphology and Pax6 expression of cultured corneal epithelial cells. (A) Hematoxylin and                                                                                                                                        |        |       |                      |                 |                                   |                                      |                             |

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**Subcellular Location Image Finder**

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Searched for:

**Captions** with the word(s) **tubulin**.

Results 1 - 10 of 16940

[Next 10 Results](#)

| Caption                                                                                                                                                                                                                    | Figure | Panel | Protein<br>↓ | Cell Type<br>↑↓ | Location Inferred from Image<br>↓ | Location Inferred from GO Terms<br>↓ | Resolution (μm/pixel)<br>↑↓ |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|--------------|-----------------|-----------------------------------|--------------------------------------|-----------------------------|
| <p>TNF does not interfere with neural stem cell differentiation.</p> <p>(A)</p> <p>Immunostaining of neuronally differentiated neurosphere-derived NSCs. Cells were cultured on poly-D-lysine/laminin-coated dishes in</p> |        |       | <p>bFGF</p>  | <p>N/A</p>      | <p>Endosome</p>                   | <p>N/A</p>                           | <p>0.09</p>                 |
| <p>TNF does not interfere with neural stem cell differentiation.</p> <p>(A)</p>                                                                                                                                            |        |       |              |                 |                                   |                                      |                             |

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[Search by protein name](#)

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[Search by location inferred from GO terms](#)

[Search by locations inferred from Images](#)

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☒ Search by pixel resolution, *within Captions* with the word(s) **tubulin**.

☐ Search by pixel resolution

The min resolution is 12 Microns/Pixel and the max is 0.05 Microns/Pixel

☒ High: 0.05 ~ 0.311

☐ Medium: 0.311 ~ 1.931

☐ Low: 1.931 ~ 12

☐ Other:  ~

Number of records displayed per page: 10

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Search by protein name, *within*  
Images with **pixel resolution** between **0.05** and **0.31072325059538597** microns/pixel, *within*  
**Captions** with the word(s) **tubulin**.

☐ Protein names extracted by CRFs

---Please select---

☐ Protein names extracted by Sprot matcher

---Please select---

☐ Protein names extracted by Uniref100 matcher

---Please select---

Search by protein name

☒ Protein names extracted by CRFs

---Please select---

☐ Protein names extracted by Sprot matcher

---Please select---

☐ Protein names extracted by Uniref100 matcher

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Search by pixel resolution

Search by protein name

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Search by locations inferred from Images

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Search by protein name, *within* Images with **pixel resolution** between **0.05** and **0.31072325059538597** microns/pixel, *within* **Captions** with the word(s) **tubulin**.

☐ Protein names extracted by CRFs

✓ ---Please select---

bFGF

Dissociated NSCs

EGF

GFAP

III

TNF

act by Sprot matcher

☐ Protein names extracted by Uniref100 matcher

---Please select---

Search by protein name

☒ Protein names extracted by CRFs

---Please select---

☐ Protein names extracted by Sprot matcher

---Please select---

☐ Protein names extracted by Uniref100 matcher

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Search by words in caption

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Search by protein name

Search for FMI figures/panels

Search by location inferred from GO terms

Search by locations inferred from Images

Browse by combination of locations inferred from GO Terms and Images

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Search by protein name, *within* Images with **pixel resolution** between **0.05** and **0.31072325059538597** microns/pixel, *within* **Captions** with the word(s) **tubulin**.

☐ Protein names extracted by CRFs

---Please select---

☐ Protein names extracted by Sprot matcher

☒ ---Please select---

ECF

GFAP

☐ Protein names extracted by Uniref100 matcher

---Please select---

Search by protein name

☒ Protein names extracted by CRFs

---Please select---

☐ Protein names extracted by Sprot matcher

---Please select---

☐ Protein names extracted by Uniref100 matcher

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Search by words in caption

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Search by protein name

Search for FMI figures/panels

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Search by locations inferred from Images

Browse by combination of locations inferred from GO Terms and Images

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Search by protein name, *within*  
Images with **pixel resolution** between **0.05** and **0.31072325059538597** microns/pixel, *within*  
**Captions** with the word(s) **tubulin**.

☐ Protein names extracted by CRFs

---Please select---

☒ Protein names extracted by Sprot matcher

✓ ---Please select---

ECF

GFAP

acted by Uniref100 matcher

---Please select---

Search by protein name

☐ Protein names extracted by CRFs

---Please select---

☐ Protein names extracted by Sprot matcher

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☐ Protein names extracted by Uniref100 matcher

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[http://slif.cbi.cmu.edu/PMC/protein\\_search.do](http://slif.cbi.cmu.edu/PMC/protein_search.do)

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Searched for:

**Protein name(s)** *GFAP*, *within*  
 Images with **pixel resolution** between **0.05** and **0.31072325059538597** microns/pixel, *within*  
**Captions** with the word(s) *tubulin*.

Results 1 - 7 of 7

| Caption                                                                                                                                                       | Figure | Panel | Protein<br>↑↓        | Cell Type<br>↑↓ | Location Inferred from Image<br>↑↓ | Location Inferred from GO Terms<br>↑↓ | Resolution (μm/pixel)<br>↑↓ | FMI and Protein Name Confidence<br>↑↓ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|----------------------|-----------------|------------------------------------|---------------------------------------|-----------------------------|---------------------------------------|
| TNF does not interfere with neural stem cell differentiation (A)<br>Immunostaining of neuronally differentiated neurosphere-derived NSCs. Cells were cultured |        |       | <a href="#">GFAP</a> | N/A             | Endosome                           | N/A                                   | 0.1                         | 0.9823                                |
| <a href="#">Click to view in a new window.</a>                                                                                                                |        |       |                      |                 |                                    |                                       |                             |                                       |
| TNF does not interfere with neural stem cell differentiation                                                                                                  |        |       |                      |                 |                                    |                                       |                             |                                       |
| <a href="#">Click to view in a new window.</a>                                                                                                                |        |       |                      |                 |                                    |                                       |                             |                                       |

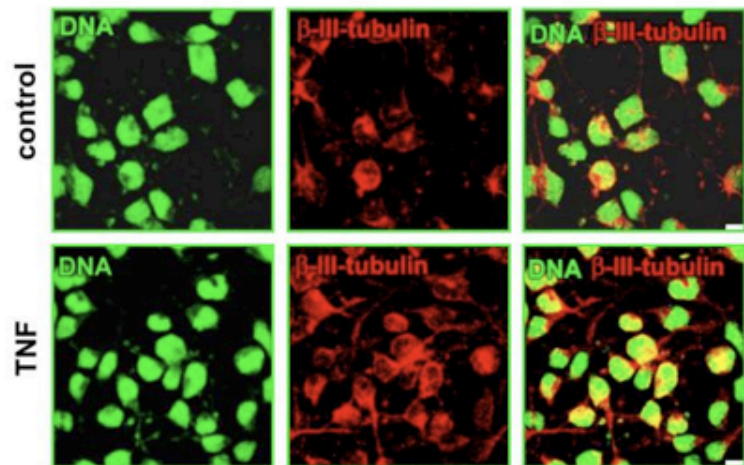
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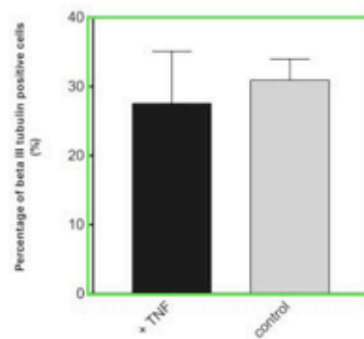
*Notes: If your browser manages only one*



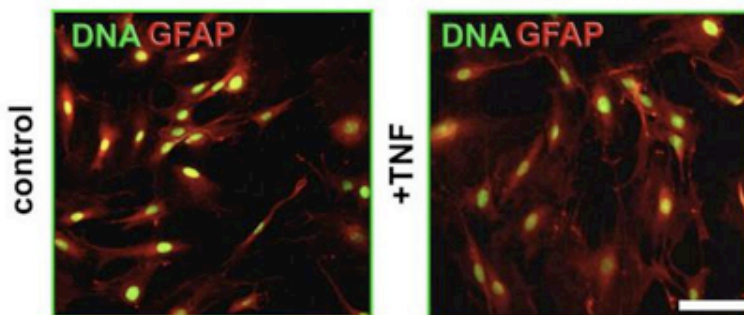
**A**



**B**



**C**



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Search by location inferred from GO terms

GO terms found for protein names extracted by

Subcellular Location: 

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✓ ---Please select---

CRFs

Sprot

Uniref100

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- Chromosome
- Cytoplasm
- Cytoplasmic Vesicle
- Cytoskeleton
- Cytosol
- Endosome
- ER
- Extracellular
- Golgi apparatus**
- Intracellular
- Membrane
- Mitochondrion
- Nuclear Membrane
- Nucleoplasm
- Nucleus
- Other Component
- Ribosome
- Undecidable

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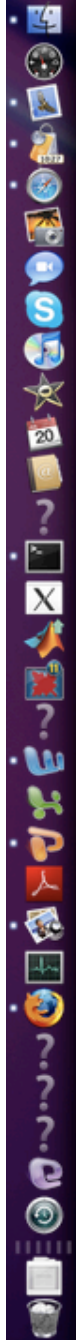
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Searched for:

**Protein name extractor(s)** Sprot, *within*  
**Locations** inferred from the GO term **Golgi apparatus**.

Results 1 - 41 of 41

| Link to PIR Query       | Link to SLIF Query                          |
|-------------------------|---------------------------------------------|
| <a href="#">ANK</a>     | <a href="#">Link to SLIF query: ANK</a>     |
| <a href="#">BSA</a>     | <a href="#">Link to SLIF query: BSA</a>     |
| <a href="#">CDK1</a>    | <a href="#">Link to SLIF query: CDK1</a>    |
| <a href="#">COX</a>     | <a href="#">Link to SLIF query: COX</a>     |
| <a href="#">COX-2</a>   | <a href="#">Link to SLIF query: COX-2</a>   |
| <a href="#">CP</a>      | <a href="#">Link to SLIF query: CP</a>      |
| <a href="#">DP</a>      | <a href="#">Link to SLIF query: DP</a>      |
| <a href="#">EGF</a>     | <a href="#">Link to SLIF query: EGF</a>     |
| <a href="#">F1</a>      | <a href="#">Link to SLIF query: F1</a>      |
| <a href="#">F2</a>      | <a href="#">Link to SLIF query: F2</a>      |
| <a href="#">FGF-1</a>   | <a href="#">Link to SLIF query: FGF-1</a>   |
| <a href="#">GAPDH</a>   | <a href="#">Link to SLIF query: GAPDH</a>   |
| <a href="#">HEK</a>     | <a href="#">Link to SLIF query: HEK</a>     |
| <a href="#">HSS</a>     | <a href="#">Link to SLIF query: HSS</a>     |
| <a href="#">HSulf-2</a> | <a href="#">Link to SLIF query: HSulf-2</a> |
| <a href="#">HTH</a>     | <a href="#">Link to SLIF query: HTH</a>     |
| <a href="#">HuR</a>     | <a href="#">Link to SLIF query: HuR</a>     |



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# SLIF

## Subcellular Location Image Finder

Searched for:

Images with **pixel resolution** between **0.2** and **1.0** microns/pixel.

Results 1 - 10 of 5390

[Next 10 Results](#)

| Caption                                                                                                                                                                                                                                                 | Figure | Panel          | Protein ↑ ↓                 | Cell Type ↑ ↓ | Location Inferred from Image ↑ ↓ | Location Inferred from GO Terms ↑ ↓ | Resolution (μm/pixel) ↑ ↓ | FMI Confiden ↑ ↓ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------|-----------------------------|---------------|----------------------------------|-------------------------------------|---------------------------|------------------|
| <p>Expression of HDGF family members in granular cells of the cerebellum. Antibodies against HDGF (A), HRP-2 (D), HRP-3 (G) and NeuN (B, E, H) were used to detect the proteins in brain slices of adult mice. Double stainings demonstrate that in</p> |        | <p>E: NeuN</p> | <p><a href="#">HDGF</a></p> | <p>N/A</p>    | <p>ER</p>                        | <p>Cytoplasm</p>                    | <p>0.2375</p>             | <p>0.9996</p>    |
| <p>Expression of HDGF family members in granular cells of the cerebellum.</p>                                                                                                                                                                           |        | <p>E: NeuN</p> |                             |               |                                  |                                     |                           |                  |

[Home](#)

[Search by words in caption](#)

[Search by pixel resolution](#)

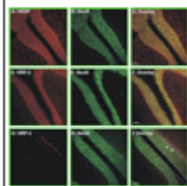
[Search by protein name](#)

[Search for FMI figures/panels](#)

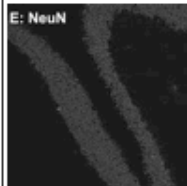
[Search by location inferred from GO terms](#)

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[Browse by combination of locations inferred from GO Terms and Images](#)



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http://slif.cbi.cmu.edu/PMC/loc\_matrix.do

# SLIF

## Subcellular Location Image Finder

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☒ Generate Location Comparison Matrix, *within* Images with **pixel resolution** between **0.2** and **1.0** microns/pixel.  
☐ Generate Location Comparison Matrix

Go

Murphy Lab SLIF Service

SLIF Web Application Version 2.1  
Database: [pmc](#)

*Note: If your browser manages only one cookie per all the windows connecting to the same server,*





## Subcellular Location Image Finder

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## About SLIF

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| GO Terms \ Images | Endosome | ER | Golgi | Lysosome | Mitochondria | Nucleolus | Tubulin | Unknown |
|-------------------|----------|----|-------|----------|--------------|-----------|---------|---------|
| Cytoplasm         | 78       | 23 | 1     | 1        | 20           | 2         | 1       | 6       |
| Cytoskeleton      | 4        | 2  | 0     | 1        | 1            | 0         | 0       | 1       |
| Cytosol           | 6        | 0  | 0     | 0        | 0            | 0         | 0       | 0       |
| ER                | 7        | 0  | 0     | 0        | 0            | 0         | 0       | 0       |
| Extracellular     | 0        | 0  | 0     | 0        | 1            | 2         | 0       | 0       |
| Golgi apparatus   | 1        | 0  | 0     | 0        | 0            | 0         | 0       | 0       |
| Membrane          | 18       | 11 | 0     | 0        | 8            | 2         | 1       | 2       |
| Mitochondrion     | 15       | 6  | 0     | 2        | 15           | 0         | 0       | 1       |
| Nucleus           | 81       | 27 | 1     | 1        | 27           | 0         | 1       | 7       |
| Other Component   | 5        | 5  | 0     | 0        | 1            | 0         | 0       | 0       |
| Undecidable       | 0        | 1  | 0     | 0        | 1            | 0         | 0       | 0       |

*Murphy Lab SLIF Service*

SLIF Web Application Version 2.1  
Database: pmc

**Note:** If your browser manages only one cookie per all the windows connecting to the same server,



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(93%) Sun 11:55 PM

[http://slif.cbi.cmu.edu/PMC/loc\\_matrix.do](http://slif.cbi.cmu.edu/PMC/loc_matrix.do)

# Subcellular Location Image Finder

Searched for:

**Locations** inferred from the GO term **Mitochondrion**, *within*  
**Location(s)** inferred from the images **Mitochondria**, *within*  
 Images with **pixel resolution** between **0.2** and **1.0** microns/pixel.

Results 1 - 10 of 32

Next 10 Results

| Caption                                                                                                                                                                                                                                                   | Figure | Panel | Protein<br>↓        | Cell<br>Type<br>↑↓ | Location<br>Inferred<br>from Image<br>↑↓ | Location<br>Inferred from<br>GO Terms<br>↓ | Resolution<br>(μm/pixel)<br>↑↓ | FMI<br>Confidence<br>↑↓ |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|---------------------|--------------------|------------------------------------------|--------------------------------------------|--------------------------------|-------------------------|
| Muscle Spindles in<br>Gastrocnemius<br>Muscle and<br>TrkA/TrkC<br>Staining in the<br>Tibial Nerve at<br>P0(A) NF-M (red)<br>and S46 (green)<br>immunostaining in<br>cross section of<br>gastrocnemius<br>muscle at P0.<br>There are no<br>muscle spindles |        |       | <a href="#">E17</a> | N/A                | Mitochondria                             | Mitochondrion                              | 0.546667                       | 0.9868                  |
| Muscle Spindles in<br>Gastrocnemius<br>Muscle and<br>TrkA/TrkC<br>Staining in the                                                                                                                                                                         |        |       |                     |                    |                                          |                                            |                                |                         |

Home

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http://slif.cbi.cmu.edu/PMC/loc\_matrix.do

# Subcellular Location Image Finder

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[Search by location inferred from GO terms](#)  
[Search by locations inferred from Images](#)  
[Browse by combination of locations inferred from GO Terms and Images](#)

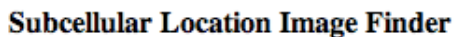
Searched for:

**Locations** inferred from the GO term **Mitochondrion**, *within*  
**Location(s)** inferred from the images **Mitochondria**, *within*  
 Images with **pixel resolution** between **0.2** and **1.0** microns/pixel.

Results 11 - 20 of 32

Next 10 Results

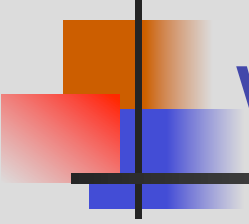
| Caption                                                                                                                                                                                                                     | Figure | Panel | Protein<br>↑ ↓       | Cell Type<br>↑ ↓ | Location Inferred from Image<br>↑ ↓ | Location Inferred from GO Terms<br>↑ ↓ | Resolution (μm/pixel)<br>↑ ↓ | FMI Confidence<br>↑ ↓ |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|----------------------|------------------|-------------------------------------|----------------------------------------|------------------------------|-----------------------|
| Immunohistochemical localization of OCTs in murine bronchi. OCT1-immunolabelling is localized to the apical membrane of ciliated epithelial cells in wild-type FVB mice (arrows in A). The specificity of this labelling is |        |       | <a href="#">OCT1</a> | N/A              | Mitochondria                        | Mitochondrion                          | 0.75                         | 0.9115                |
| Immunohistochemical localization of OCTs in murine bronchi. OCT1-immunolabelling is                                                                                                                                         |        |       |                      |                  |                                     |                                        |                              |                       |

[Help](#)

**Note:** If your browser manages only one cookie per all the windows connecting to the same server

☐ Search by pixel resolution

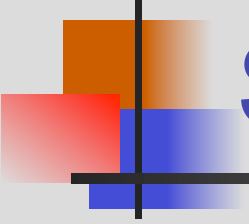
The min resolution is 12 Microns/Pixel and the max is 0.05 Microns/Pixel



# Linking to SLIF from another website

---

- Queries against the database can be made from outside the website using `http://slif.cbi.cmu.edu/PMC/search.jsp?arguments`
- The arguments are:
  - `protein=<protein name>`
  - `level=figure` OR `level=panel`
  - `type=FMI` (NOTE that BOTH level and type must be present if either is present)
  - `pixel_size_lo=<lower bound>`
  - `pixel_size_hi=<upper bound>` (NOTE that both upper and lower bounds must be specified)
  - `location=<subcellular location>`



# SOAP interface - query DTD

```
<!ELEMENT slif_query  
  (protein_name,  
   fmi_level,  
   pixel_res_lower_bound,  
   pixel_res_upper_bound,  
   subcellular_location)>  
<!ELEMENT protein_name (#PCDATA)>  
<!ELEMENT fmi_level EMPTY>  
<!ATTLIST fmi_level figure_or_panel (figure|panel)  
  #REQUIRED>  
<!ELEMENT pixel_res_lower_bound (#PCDATA)>  
<!ELEMENT pixel_res_upper_bound (#PCDATA)>  
<!ELEMENT subcellular_location (#PCDATA)>
```

# SLIF web client

edu.cmu.slif.xml.SLIFPMCSearch

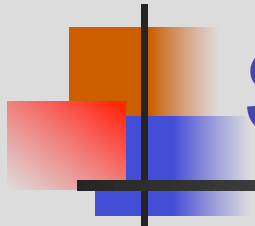
SLIF Search

Search Criteria

|                                                                          |                                                                  |                                                                   |
|--------------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------|
| Protein Name<br><input type="checkbox"/> <input type="text"/>            | GO Location<br><input type="checkbox"/> <input type="text"/>     | Words in Caption<br><input type="checkbox"/> <input type="text"/> |
| FMI Level<br><input type="checkbox"/> <input type="text" value="panel"/> | Max. Image Res.<br><input type="checkbox"/> <input type="text"/> | Min. Image Res.<br><input type="checkbox"/> <input type="text"/>  |
| Article Id<br><input type="checkbox"/> <input type="text"/>              | <input type="button" value="Search SLIF"/>                       |                                                                   |

Results

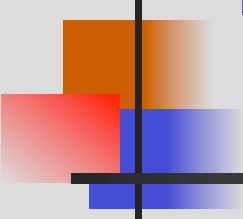




# SLIF web client options

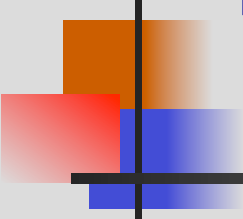
---

|      |                               |
|------|-------------------------------|
| -gui | launches GUI search utility   |
| -p   | protein name                  |
| -il  | image level (figure or panel) |
| -go  | GO location                   |
| -hr  | highest image resolution      |
| -lr  | lowest image resolution       |
| -id  | article id                    |
| -w   | words in caption              |



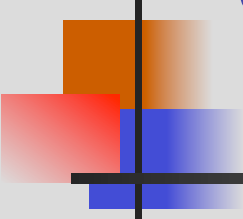
```
java -jar SLIFPMCSearch.jar -lr 0.2 –  
hr 2.0 -il panel
```

```
<?xml version="1.0"?>  
<!DOCTYPE slif_query_results SYSTEM "http://slif.cbi.cmu.edu/  
    slif_result.dtd">  
<slif_query_response>  
  <query>  
    <fmi_level>panel</fmi_level>  
    <scale>0.2,2.0,</scale>  
  </query>  
  <result_summary>  
    <num_records>8202</num_records>  
  </result_summary>  
  <query_results>  
  
    <slif_result>  
      <caption>
```



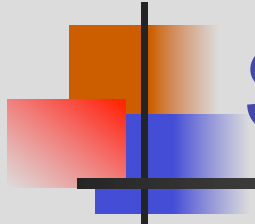
```
java -jar SLIFPMCSearch.jar -lr 0.2 –  
hr 2.0 -il panel
```

```
<slif_result>  
<caption>notch and delta gene expression in zebrafish ...</  
caption>  
<figure_url>p005-paper/paper4439-figure/figure0001-  
image_box.jpg</figure_url>  
<panel_url>p005-paper/paper4439-figure/figure0001-panel/  
panel_6_green-image.jpg</panel_url>  
<protein_name>n1b</protein_name>  
<cell_name>N/A</cell_name>  
<subcellular_location>Endosome</subcellular_location>  
<pixel_resolution>1.6</pixel_resolution>  
</slif_result>
```



```
java -jar SLIFPMCSearch.jar -p  
cadherin -il panel
```

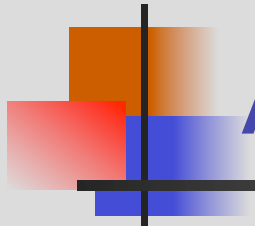
```
<?xml version="1.0"?>  
<!DOCTYPE slif_query_results SYSTEM "http://slif.cbi.cmu.edu/  
  slif_result.dtd">  
<slif_query_response>  
  <query>  
    <protein>cadherin,</protein>  
    <fmi_level>panel</fmi_level>  
  </query>  
  <result_summary>  
    <num_records>8</num_records>  
  </result_summary>  
  <query_results>
```



# Summary

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- Complex pipeline for parsing figure and caption pairs
- Web pages to provide interactive access to results of analysis
- Web service for programmatic access
- Work continues...



# Acknowledgments

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