

# **How to use the Comparative Pathology Workbench**

**By Mike Wicks**

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## **2 Introduction**

This document describes how to use the Comparative Pathology Workbench (CPW); terms are first described, with a brief overview of the system, followed by a more detailed description of the typical tasks a user could expect to achieve within the CPW.

### 3 What is the CPW?

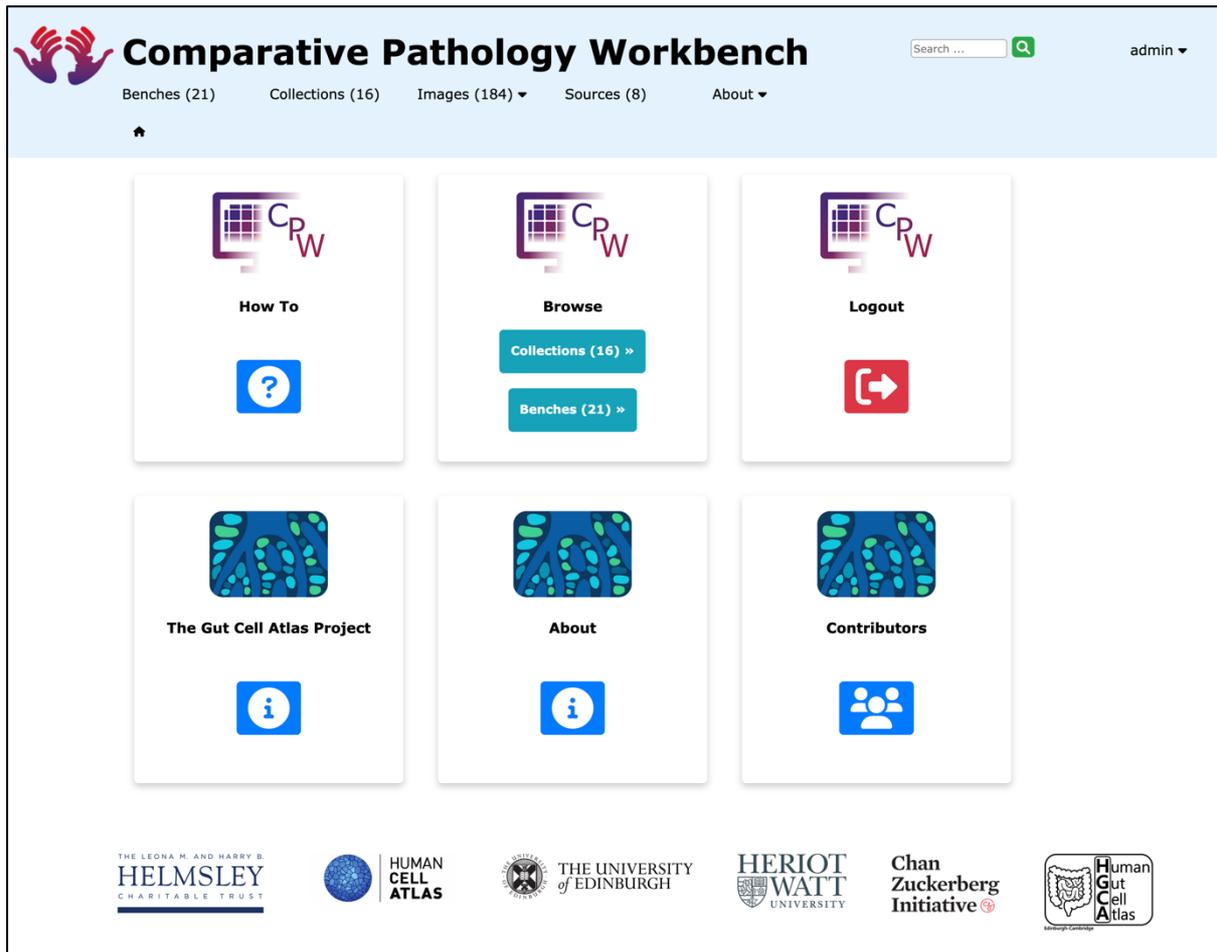


Figure 1 – The CPW Home Page

The CPW is intended to be used by Pathologists to organise histopathological image and other image-related related data and metadata from multiple disparate sources.

To this end, we have created the concept of a “Bench”; this is a user-configurable grid of “Cells” arranged in rows and columns (similar to the concept of a spreadsheet), that can be populated with data and metadata, as the User sees fit.

### 3.1 The CPW Header Panel



Figure 2 – The CPW Header Panel

At the top of every page in the CPW, there is a common header panel, which includes the following main menu options:

- Benches
  - This displays the List Benches page;
- Collections
  - This displays the List Collections page;
- Images
  - This displays the List Images page, either from your Active Collection or all your images from all your Collections;
- Sources
  - This displays the List Sources page;
- About
  - Displays further pages:
    - About (general information on the CPW),
    - People (involved in the creation and construction of the CPW) and
    - How To (use the CPW);
- Search Box
  - a general search box, that searches for Benches that contain the string supplied (case sensitive) in their titles, descriptions, owners or authorities.
- User
  - If a User is Logged in, User account functions are displayed, including
    - Logout,
    - Bench Permissions (See later section on Sharing),
    - Collection Permissions (See later section on Sharing),
    - Change Password, and
    - My account (information).
  - If a User is not Logged in, only the Login and Registration options are displayed.

## 3.2 The Home Page

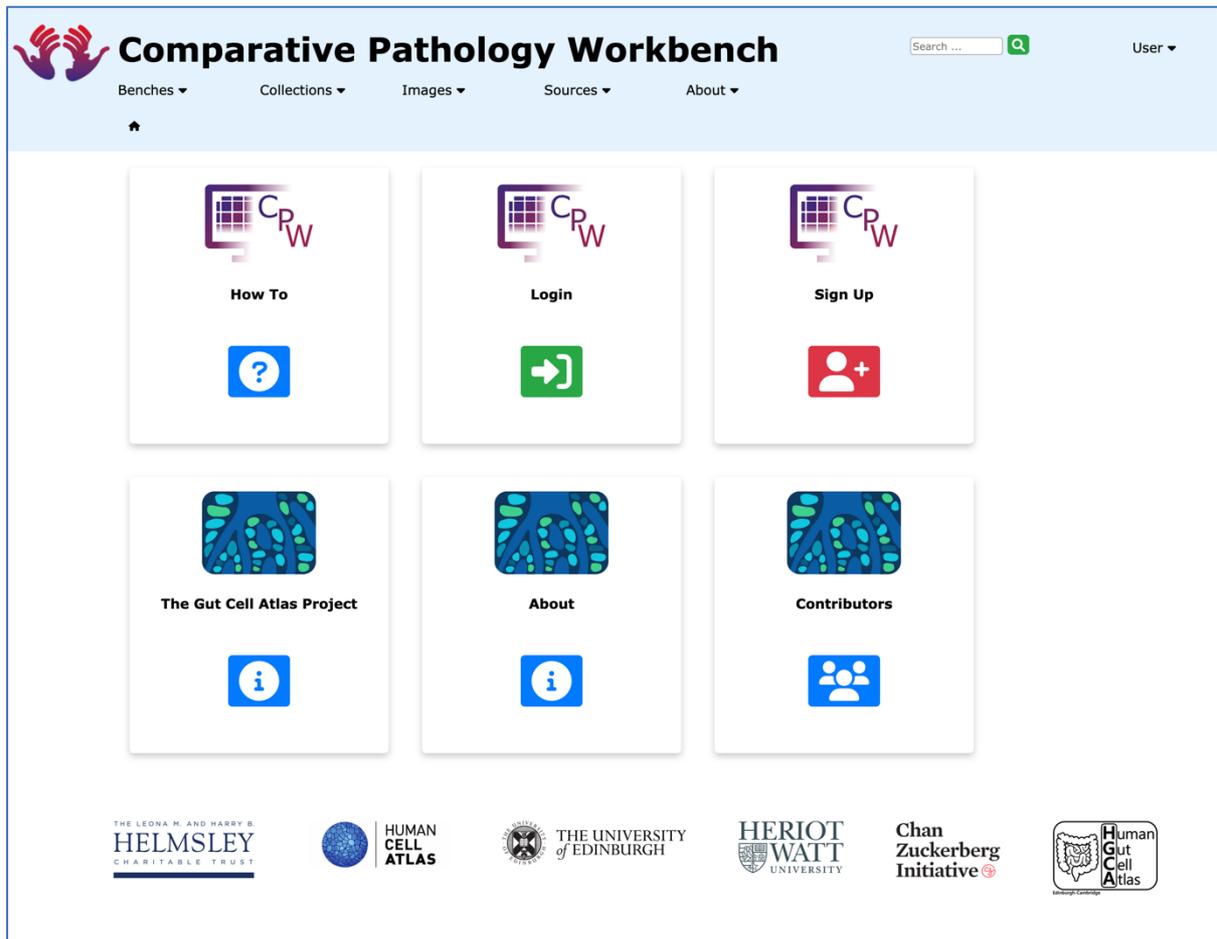


Figure 3 – The CPW Home Page, with a user not logged In

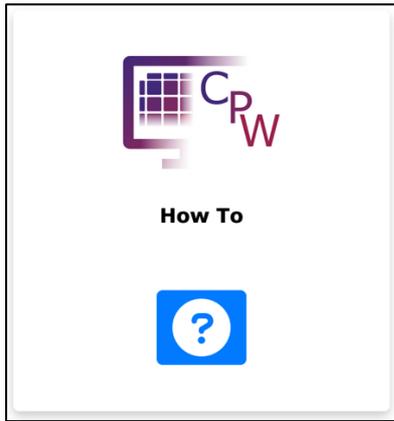
When no user is logged in, the Home page offers the following short cut functions via buttons within 6 “cards”:

“How To”, “Login”, “Register”, “About”, “Contributors” and “The Centre for Comparative Pathology”

When a User is logged in, the home page offers the following short cut functions via buttons within 6 “cards”:

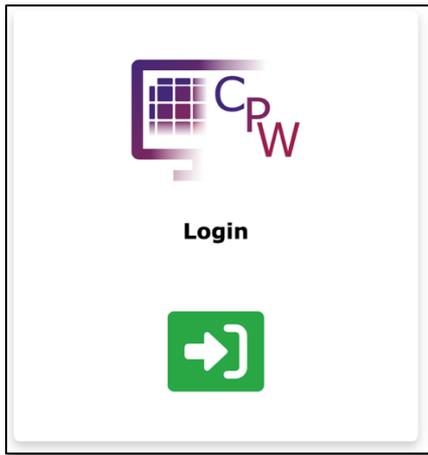
“How To”, “Browse”, “Logout”, “About”, “Contributors” and “The Centre for Comparative Pathology”.

### 3.2.1 The Home Page Cards



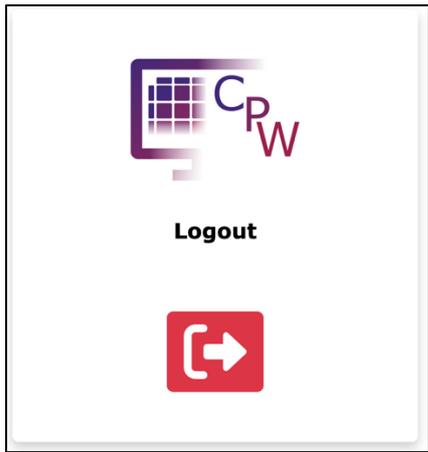
*Figure 4 – The CPW Home Page Card – “How To”*

Clicking on this is the same as clicking on the “About”, “How To” main menu option.



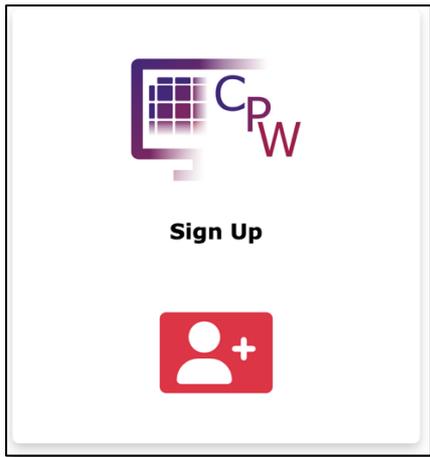
*Figure 5 – The CPW Home Page Card – “Login”*

Clicking on this is the same as clicking on the “User”, “Login” main menu option.



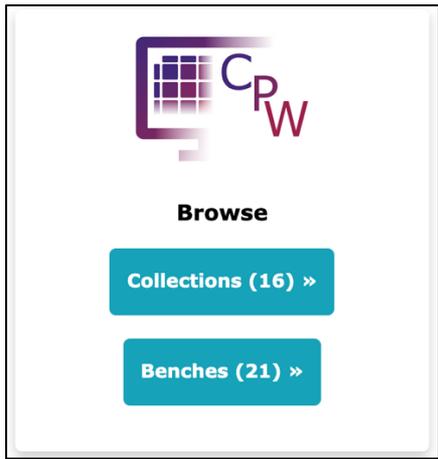
*Figure 6 – The CPW Home Page Card – “Logout”*

Clicking on this is the same as clicking on the “User”, “Logout” main menu option.



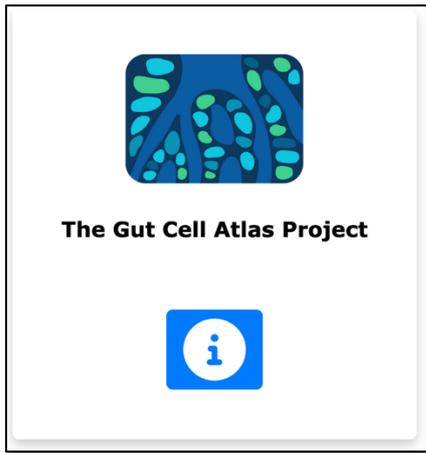
*Figure 7 – The CPW Home Page Card – “Sign Up”*

Clicking on this is the same as clicking on the “User”, “Sign Up” main menu option.



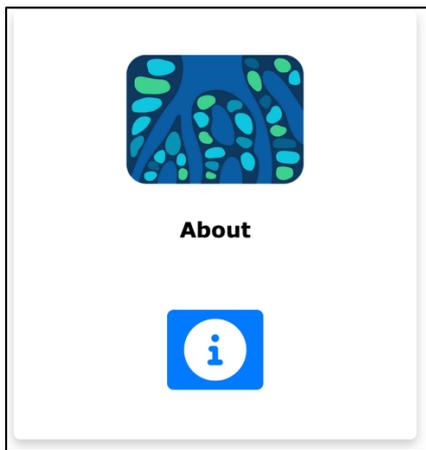
*Figure 8 – The CPW Home Page Card – “Browse”*

Clicking on “Collections” is the same as clicking on the “Collections” main menu option.  
Clicking on “Benches” is the same as clicking on the “Benches” main menu option.



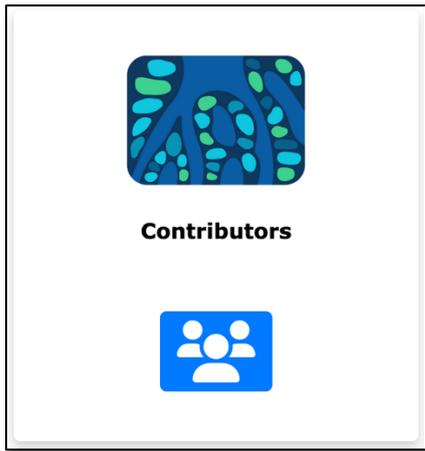
*Figure 9 - The CPW Home Page Card – “The Gut Cell Atlas Project”*

Clicking on this takes the User to The Gut Cell Atlas Project website.



*Figure 10 - The CPW Home Page Card – “About”*

Clicking on this takes the User to The Gut Cell Atlas Project website, Summary Page.



*Figure 11 – The CPW Home Page Card – “Contributors”*

Clicking on this takes the User to The Gut Cell Atlas Project website, The Team Page.

## 4 Nomenclature

The CPW uses the following terms to describe the components that it can manage and organise:

### 4.1 Sources

The list of available Sources can be viewed by selecting the “Sources” main menu option within the CPW.

There are 4 types of data source that the CPW can handle:

1. OMERO servers,
2. WordPress Media Libraries,
3. The European Bioinformatics Institute (EBI) Single Cell Atlas (SCA) and
4. The CPW itself.

The CPW can be updated to include as many of these types of data source as required.

#### 4.1.1 OMERO Servers

OMERO servers provide a JSON interface that allows the resources that it manages to be exposed, via unique URLs. The CPW uses this interface to provide a set of screens that enable easy navigation through the available resources.

The user of the CPW can drill down through as many available Groups, Projects and Datasets stored on an OMERO server, that the credentials stored with the source definition in the CPW, allows.

The displayed Groups, Projects and Datasets mirror exactly those available on the OMERO server.

The User can upload image files (such as scanned histopathology sections, or photomicrographs of parts of sections, or macroscopic pathology images, or any other relevant image) to OMERO and then view the images, within a Dataset (and their Regions Of Interest (ROIs) if any), for bringing into and further processing by the CPW.

#### 4.1.2 The EBI Single Cell Atlas (SCA)

The EBI Single Cell Atlas (SCA) provides a highly configurable set of URLs that precisely define “tSNE” and “UMAP” charts that it can provide to the User.

The CPW can store charts downloaded from these URLs as images locally. The User can select these images for further processing by the CPW.

### **4.1.3 WordPress Media Libraries**

The CPW uses a WordPress server to provide a commentary facility; However, a WordPress server can also be used to store miscellaneous images. The User can select these images for further processing by the CPW.

### **4.1.4 The CPW itself**

Miscellaneous images can also be added to the CPW itself, along with a supporting comment and a URL providing relevant provenance. The User can select these images for further processing by the CPW.

## 4.2 Images

The list of available images can be viewed by selecting the “Images” main menu option within the CPW, and further selecting either the “Current Collection” or “All Images” sub menu options.

The CPW can store any images locally within its system (CPW and EBI SCA server types); as well as storing references to images that are held on other systems. These references are to images held on the 2 types of system mentioned previously (OMERO servers, and WordPress Servers).

The following figures show examples of images referenced in the CPW from the various types of Image source:

- Figure 12 shows an Image referenced from an OMERO Server;
- Figure 13 shows an ROI from an Image referenced from an OMERO server;
- Figure 14 shows a t-SNE chart showing gene expression patterns held on a WordPress Server;
- Figure 15 shows a t-SNE Chart downloaded from a URL from the EBI SCA;
- And finally, Figure 16 shows an annotated image generated using QuPath, stored locally on the CPW itself.

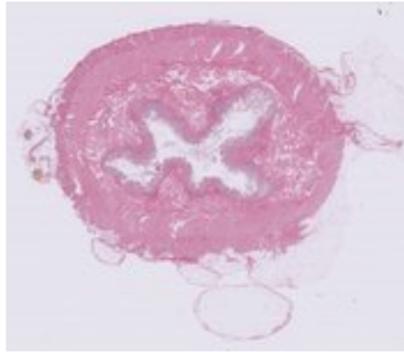
## 2021.03.12-SR149220...

### Image Information

**Image Name:** 2021.03.12-SR149220\_02\_PSR\_Healthy.ndpi [0]

**Image Description:** 680058

Image:



Dimensions (XY): 98304 x 86016

Pixels Type:

Pixels Size (XYZ) ( $\mu\text{m}$ ): 0.2267 x 0.2267

Z-sections/Timepoints: 1 x 1



Figure 12 – An Image referenced from an OMERO Server

Home / Sources / mwicks23@CompPathUofE / MVM / imagesFromOneDrive / images / ETGM10-A1.LI.ndpi [...]

---

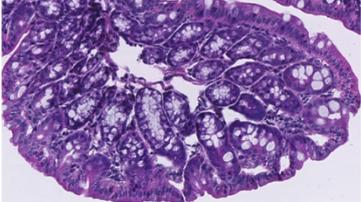
### Regions Of Interest (ROIs)

Image has 3 ROIs

---

ROI ID: 61  
Coordinates: X: 19915, Y: 15456, Width: 2520, Height: 1456

Polygon



+  
👁

Figure 13 – An ROI from an Image referenced from an OMERO server

# E-HCAD-11\_CCL8\_gene-expression

## Image Information

**Image Caption:**

**Image Description:**

Image:

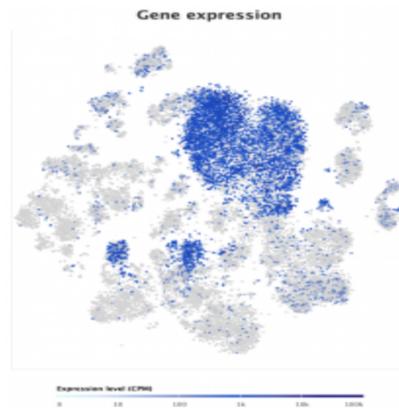


Figure 14 – A t-SNE image showing gene expression patterns held on a WordPress Server

🏠 / Sources / EBI Single Cell Atlas /

## Chart: 20220803-10:12:41.564 E-HCAD-11 TSNE 20 11 NoGene

**Image Information**

---

**Experiment:** E-HCAD-11  
**Chart Name:** 20220803-10:12:41.564 E-HCAD-11 TSNE 20 11 NoGene

**Image:**

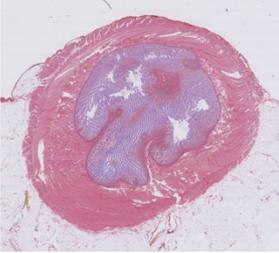


**Plot Type:** TSNE  
**Perplexity:** 20  
**Cluster By:** 11  
**Gene:** None  
**Comment:** Cluster Chart for experiment E-HCAD-11 from the EBI SCEA

Figure 15 – A t-SNE Chart downloaded from a URL from the EBI SCA.

🏠 / Sources / THIS Comparative Pathology Workbench /

**Image:**  
**20220927-13:19:25.772\_SR149216\_Healthy\_annotated.tif.jpeg**



**Image Information**

<b>Image Name:</b>	20220927-13:19:25.772_SR149216_Healthy_annotated.tif.jpeg
<b>Comment:</b>	An Annotated Image from Qupath
<b>Source:</b>	<a href="https://omero-czi-cpw.mvm.ed.ac.uk/webclient/?show=image-8390">https://omero-czi-cpw.mvm.ed.ac.uk/webclient/?show=image-8390</a>

+  
👁

Figure 16 – An annotated image generated using QuPath, stored locally on the CPW itself.

When the user of the CPW has found an image of interest, the image must be added to a Collection before it can be added to a Bench

## 4.3 Collections

The list of available Collections can be viewed by selecting the “Collections” main menu option within the CPW.

**Comparative Pathology Workbench**

Benches (5) Collections (7) Images (25) Sources (7) About

Search ... mwicks23

### Collections

Search the list of Collections

Title: Description: Owner: Authority: Paginate by: 10

Search Clear

Action	Collection Id	Title	Images	Owner	Authority
☰	000003	GUEST Default Collection	5	guest	VIEWER
☰	000004	Default Collection	9	rbaldock	VIEWER
☰	000011	Normal and Crohns Examples	9	mwicks23	OWNER
☰	000014	EBI SCA Collection	2	mwicks23	OWNER
☰	000016	A Simple Collection	9	mwicks23	OWNER
☰	000022	Test Collection	2	mwicks23	OWNER
☰	000023	Default Collection	0	mwicks23	OWNER

+ Add

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Figure 17 –The Collection List Page

The Collections List page provide full search facilities for the users’ collections, as well as the pagination amount.

A Collection is a set of images that the user has gathered together in a single, named group; a collection can hold references to images from many different sources.

Initially, a new user has NO collections, and must create one to start collecting images. Each collection must have a name and description. A collection can be marked as “Active”. Setting the active collection can be done on both the “List Collections” and “View Collections” pages. The Active Collection on the “List Collections” page is indicated by the red background, underneath the relevant collection.

The Active Collection is the collection that houses any images that are selected and saved by the User from browsing the Image Sources.

When browsing images from the sources available to the CPW, the user is offered the chance to add that image to a Collection; images are always added to the users Active Collection.

The images in collections can then be used by the User to populate a Bench.

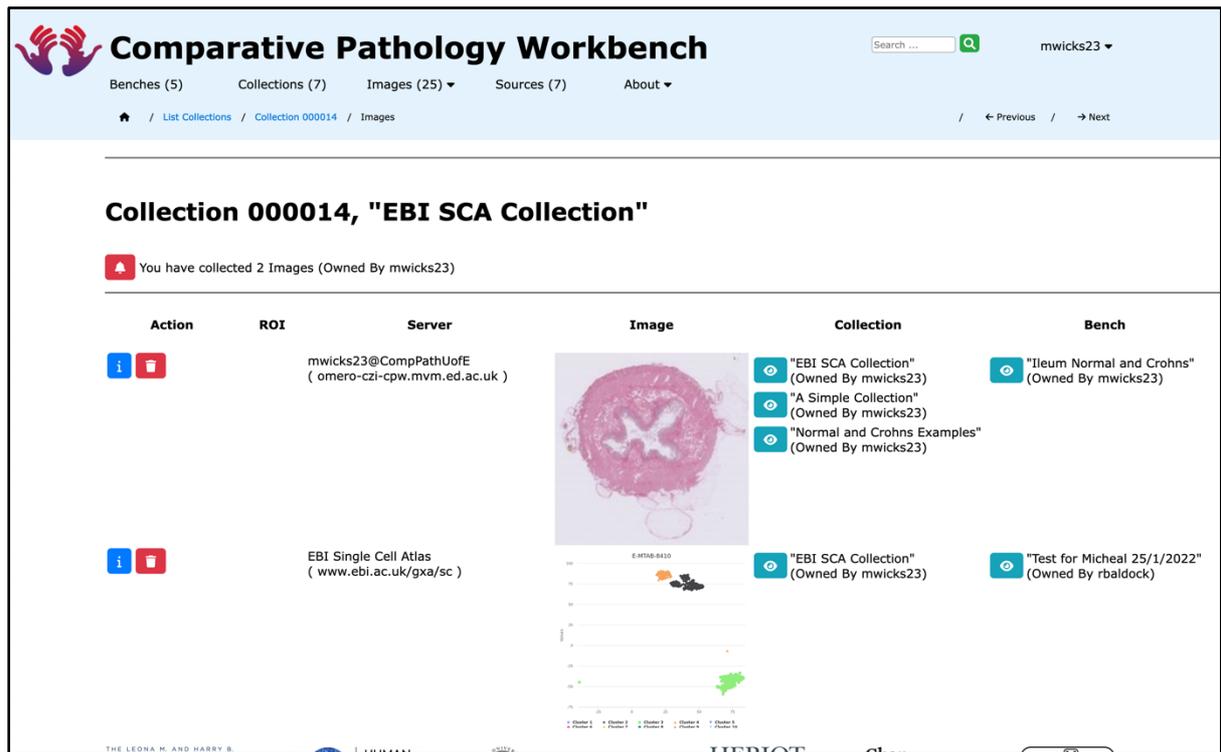


Figure 18 – An example of a Collection with some images

If the collection being viewed is not the Active Collection, then a Red Bell button is shown to allow the user to active this collection.

**Comparative Pathology Workbench**

Search ... mwicks23 ▾

Benches (5) Collections (7) Images (25) Sources (7) About ▾

Home / List Collections / Collection 000014 / Images / Previous / Next

---

## Collection 000014, "EBI SCA Collection"

You have collected 2 Images (Owned By mwicks23)

Action	ROI	Server	Image	Collection	Bench
		mwicks23@CompPathUofE ( omero-czi-cpw.mvm.ed.ac.uk )		<ul style="list-style-type: none"> <li> "EBI SCA Collection" (Owned By mwicks23)</li> <li> "A Simple Collection" (Owned By mwicks23)</li> <li> "Normal and Crohns Examples" (Owned By mwicks23)</li> </ul>	"Ileum Normal and Crohns" (Owned By mwicks23)
		EBI Single Cell Atlas ( www.ebi.ac.uk/gxa/sc )		"EBI SCA Collection" (Owned By mwicks23)	"Test for Micheal 25/1/2022" (Owned By rbaldock)








Figure 19 – An Active Collection

When viewing an Active Collection, the Heading is shown with a Red background banner.

The collection is displayed on the left-hand side of the Bench page, thus:

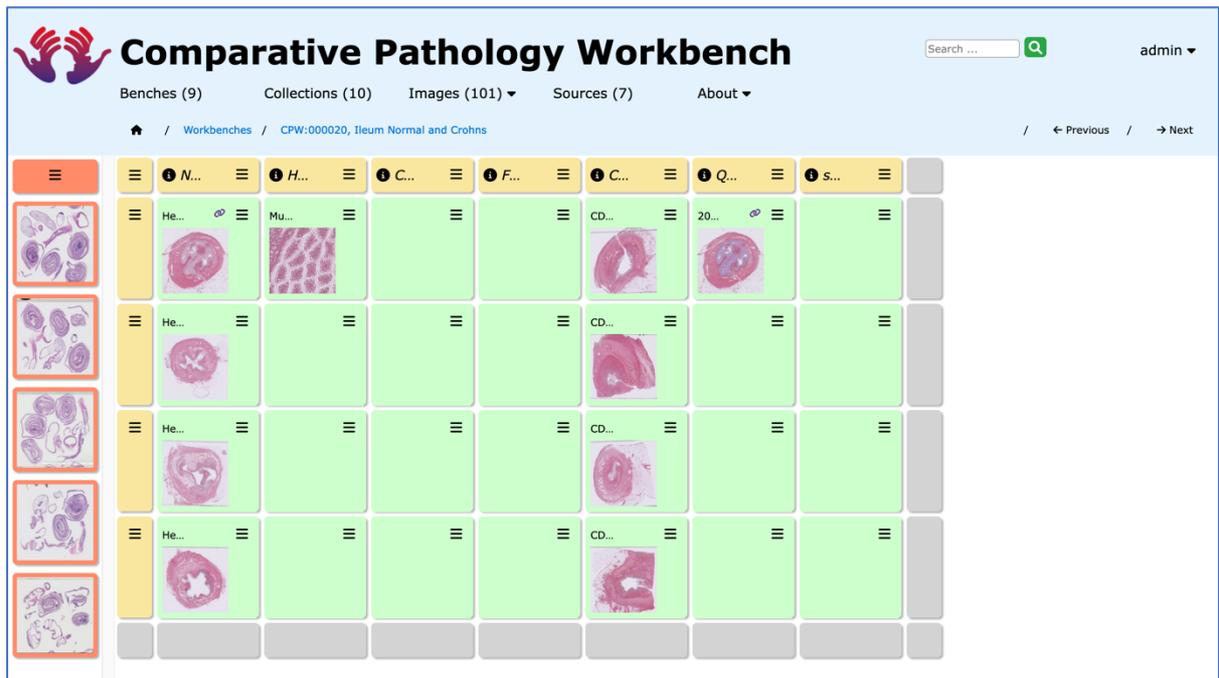


Figure 20 –a Collection displayed on the Bench Page

## 4.4 Benches

The list of available Benches can be viewed by selecting the “Benches” main menu option within the CPW.

**Comparative Pathology Workbench**

Search ...   mwicks23 ▾

Benches (4) Collections (6) Images (25) ▾ Sources (7) About ▾

🏠 / Benches

### Benches

Search the list of Benches

Title:  Description:  Owner:  Authority:  Paginate by: 10 ▾

Created before:  Created after:  Modified before:  Modified after:

Action	Bench Id ▲	Title	Created On	Updated On	Owner	Authority
<input type="checkbox"/>	CPW:000016	Test bench for sharing	2020/09/15	2022/09/08	rbaldock	VIEWER
<input type="checkbox"/>	CPW:000020	Ileum Normal and Crohns	2021/05/17	2022/11/15	mwicks23	OWNER
<input type="checkbox"/>	CPW:000025	Test for Micheal 25/1/2022	2022/01/25	2022/02/22	rbaldock	EDITOR
<input type="checkbox"/>	CPW:000030	CPW_Manuscript	2022/09/28	2022/10/28	mglinka	EDITOR

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Figure 21 – The Benches List Page

As described previously, a Bench is a grid of cells, which can house references to images; the Bench has a user definable title and description.

On the creation of a Bench, the User may specify the initial number of rows and columns (between 1 to 10)

More Rows and Columns can be added later; the size of the cells in the grid is specified when the Bench is created, but can also be amended later as the User sees fit.

The row and column headers in the Bench can be given titles and descriptions, as the user requires. Benches can be increased or decreased in size by adding or removing rows and columns of cells.

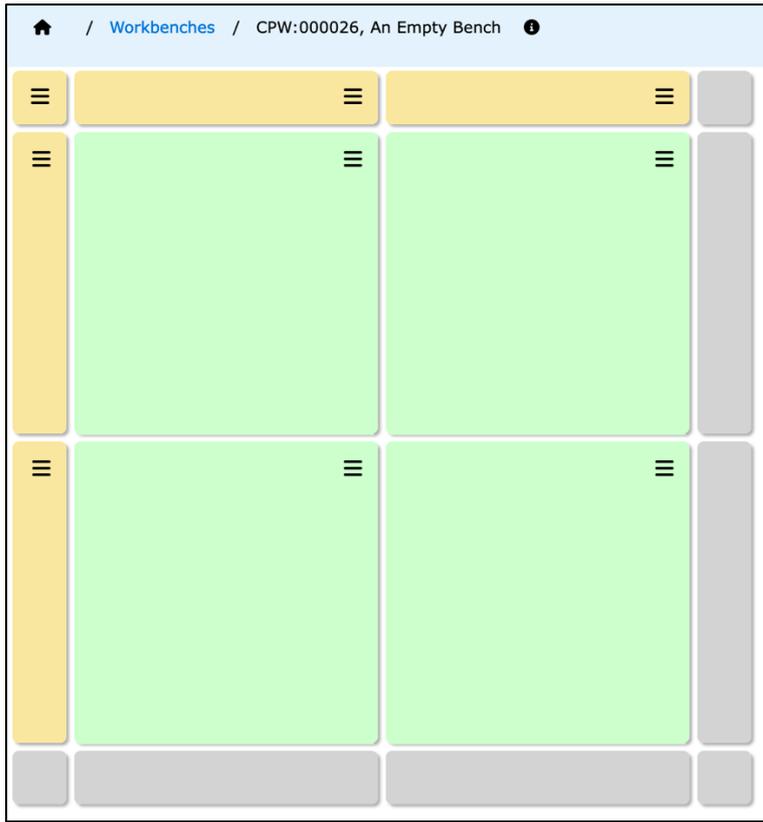


Figure 22 – An Empty Bench

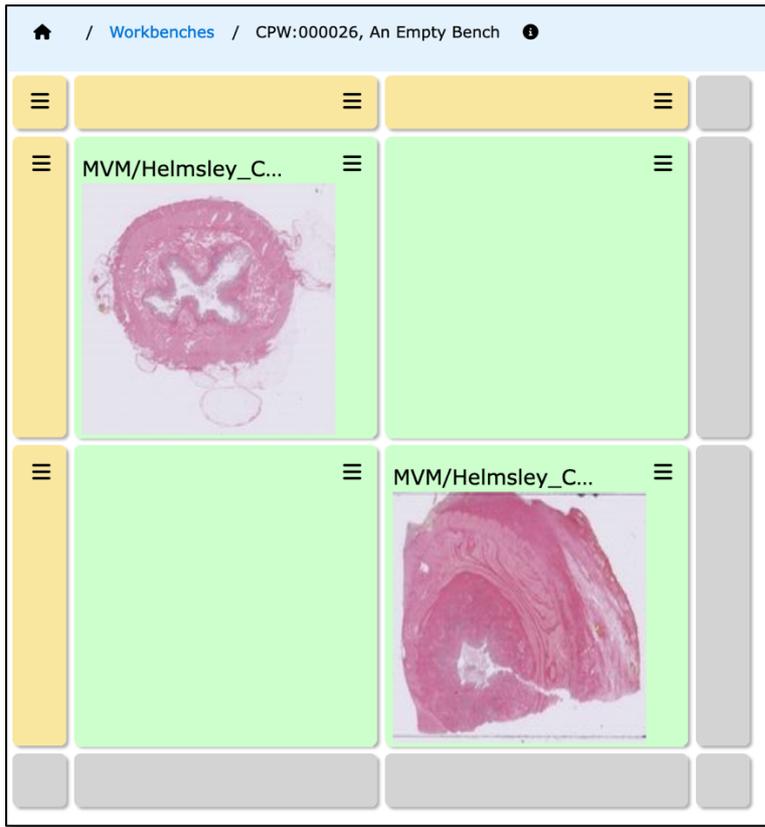


Figure 23 – A Bench with images

## **5 Tasks**

There are a number of typical tasks that a User will want to achieve with the CPW:

### **5.1 Registering as a new User**

On the Home page, the User can click on the red “Registration” button to register as a new user of the CPW. The User can then fill in the form and press “Sign Up”, with the registration confirmed by email.

The User of the CPW will also need to register on the Comparative Pathology WordPress site to ensure use of the full functionality of the Workbench. The CPW Administrator will provide instructions for the User to do this.

The User of the CPW must contact the CPW administrator for further instructions.

### **5.2 Logging into the CPW**

From the Home page, the User must click on green “Login” button to login into the CPW.

### 5.3 Creating a Collection

From the Home page, the User must first click on the “Collections” main menu item to display the List Collections page.

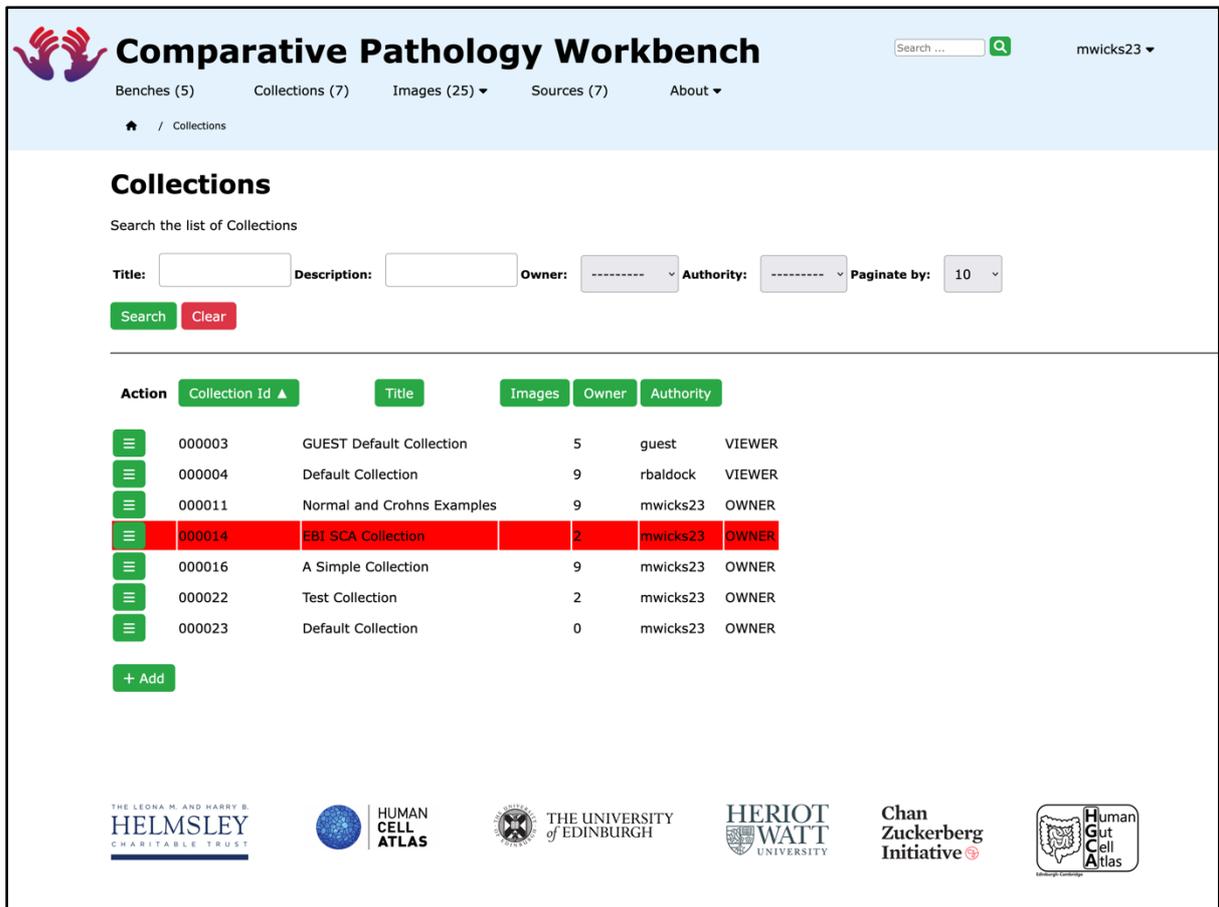


Figure 24 – the Collection List page



Before the User can collect images to populate a Bench with, a Collection must be created, by pressing the green “Plus” icon on the List Collections page.

The image shows a software dialog box titled "Create a Collection ...". It features a title bar with a grid icon on the left and a close button (X) on the right. The main content area is white and contains two labeled input fields: "Title:" followed by a single-line text box, and "Description:" followed by a larger multi-line text box. At the bottom right of the dialog, there are two buttons: "Save" and "Cancel".

Figure 25 – the Collection Add pop-up

The User must supply a title and description for the Collection.

The List Collections page provides a search facility for the User to list Collections, depending on the following criteria:

- Title
  - The Title of the Collection contains the supplied sting in the matching text box.
- Description
  - The Description of the Collection contains the supplied sting in the matching text box.
- Owner
  - The Owner of the Collection is chosen from the list of available users.
- Authority

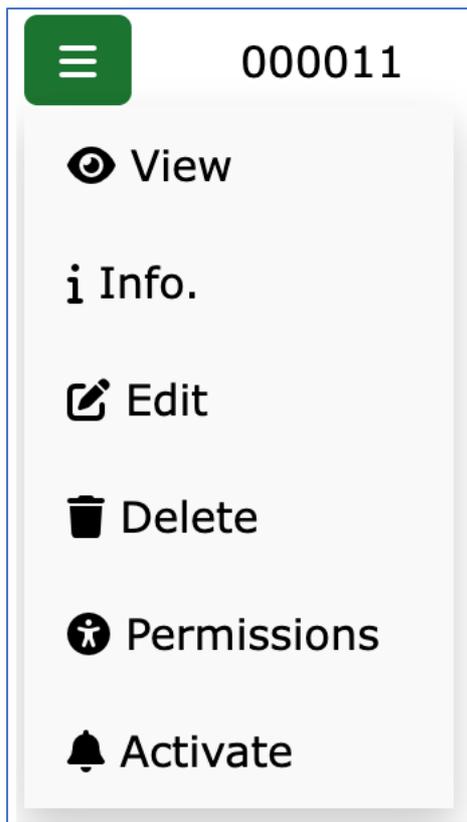
- The Authority assigned to the User over the Collection is chosen from the list of available authorities (“VIEWER” only).
- Paginate By
  - The Number of Collections to be displayed per Page
    - Use this without any of the other parameters to alter the pagination of the Collection list.

The Pagination amount for the List Collections page can also be controlled here, as well as providing controls for page selection:



- “<<”
  - Go to the First page
- “<”
  - Go to the Previous page
- <a number>
  - Go to page N
- “>”
  - Go to the Next page
- “>>”
  - Go to the Last page

Each Collection has an associated menu accessed by clicking on the green “hamburger” icon:



*Figure 26 - The Collection Menu*

Here the user can do the following:

- View the Collection
- View the Collection Details (“Info.”)
- Edit the Collection Details
- Delete the Collection
- View the Permissions for the Collection
- Activate the Collection to make it the user’s Active Collection

A Collection can be viewed using the “View” menu option:

**Comparative Pathology Workbench** Search ...   mwicks23 ▾

Benches (4) Collections (6) Images (25) Sources (7) About ▾

Home / List Collections / Collection 00011 / Images / Previous / Next

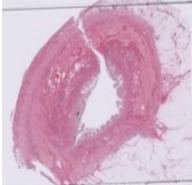
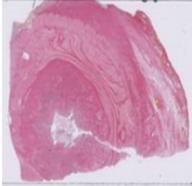
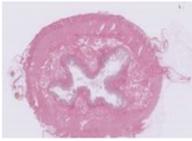
Action	ROI	Server	Image	Collection	Bench
 		mwicks23@CompPathUofE ( omero-czi-cpw.mvm.ed.ac.uk )		<ul style="list-style-type: none"> <li>"A Simple Collection" (Owned By mwicks23)</li> <li>"Normal and Crohns Examples" (Owned By mwicks23)</li> <li>"Test Collection" (Owned By mwicks23)</li> </ul>	"Ileum Normal and Crohns" (Owned By mwicks23)
 		mwicks23@CompPathUofE ( omero-czi-cpw.mvm.ed.ac.uk )		<ul style="list-style-type: none"> <li>"A Simple Collection" (Owned By mwicks23)</li> <li>"Normal and Crohns Examples" (Owned By mwicks23)</li> <li>"Test Collection" (Owned By mwicks23)</li> </ul>	"Ileum Normal and Crohns" (Owned By mwicks23)
 		mwicks23@CompPathUofE ( omero-czi-cpw.mvm.ed.ac.uk )		<ul style="list-style-type: none"> <li>"EBI SCA Collection" (Owned By mwicks23)</li> <li>"A Simple Collection" (Owned By mwicks23)</li> <li>"Normal and Crohns Examples" (Owned By mwicks23)</li> </ul>	"Ileum Normal and Crohns" (Owned By mwicks23)













Figure 27 – A typical Collection

## 5.4 Finding Images & Adding Images to a Collection

From the Home page, the User must first click on the “Source” main menu option.

**Comparative Pathology Workbench**

Benches (9) Collections (10) Images (101) Sources (7) About

Search ... Q admin

Home / Sources

### Search Sources

Search the sources with a URL (OMERO source ONLY!):

Url string:

Action	Owner	Name	URL	Type
	admin	Your WordPress Images	workbench-czi-cpw.mvm.ed.ac.uk/wordpress	WORDPRESS
	admin	public@IDR	idr.openmicroscopy.org	OMERO_5.4.7
	admin	mwicks23@CompPathUofE	omero-czi-cpw.mvm.ed.ac.uk	OMERO_5.4.7
	admin	public_user@CompPathUofE	omero-czi-cpw.mvm.ed.ac.uk	OMERO_5.4.7
	admin	CPW - CZI OMERO server	omero-czi-cpw.mvm.ed.ac.uk	OMERO_5.4.7
	admin	EBI Single Cell Atlas	www.ebi.ac.uk/gxa/sc	EBI_SCA
	admin	THIS Comparative Pathology Workbench	workbench-czi-cpw.mvm.ed.ac.uk/highcharts	CPW

[+ Add](#)

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Figure 28 – the Source List Page

A list of sources is presented to the User, and clicking on the green “hamburger” icon next to a source of interest, shows the Source Menu options:

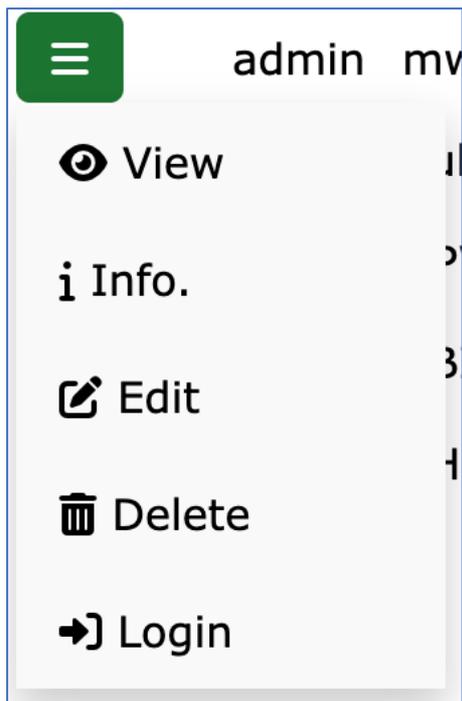


Figure 29 – the Source Menu

Here the user can do the following:

- View the Source.
- View the Source Details (“Info.”)
- Edit the Source Details.
- Delete the Source (if allowed).
- Login to the Source

Depending on the type of source being browsed, different options are presented to the User.

Some types of Image Source, typically certain OMERO servers, require you to login separately in another tab in the same browser. If the User needs to do this, “Login” option is displayed in the Source dropdown menu. Clicking on this prompts the CPW User to login to this external system, with the browser returning to the originating page in the CPW.

#### 5.4.1 OMERO Images

For an OMERO source type, the User is presented with a list of Groups available on the OMERO server.

- Clicking on a Group, shows the list of available Projects within the selected Group;
- Clicking on the Project, shows the list of available Datasets within the selected Project;

- Clicking on the Dataset shows the list of available Images within the selected Dataset;
- Clicking on the Image shows the Image, its metadata and any Regions Of Interest, if available.

The selected image can be added to the User's active collection, by pressing the green "Plus" button followed by the confirmation pop-up dialogue.

If the Image has Regions of Interest (ROIs), displayed by scrolling down from the image, then these can be added to the User's active collection, by pressing the green "Plus" button followed by the confirmation pop-up dialogue.

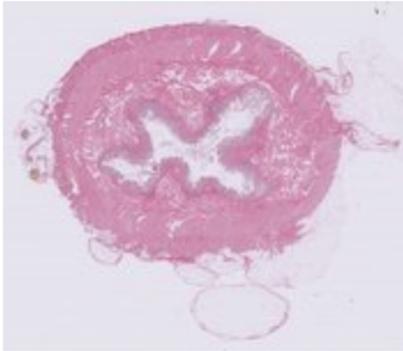
Home / Sources / mwicks23@CompPathUofE / MVM / Helmsley\_CD / 2021.03.12 - PSR\_he... / 2021.03.12-SR149220...

## 2021.03.12-SR149220...

### Image Information

<b>Image Name:</b>	2021.03.12-SR149220_02_PSR_Healthy.ndpi [0]
<b>Image Description:</b>	680058

Image:



Dimensions (XY): 98304 x 86016  
Pixels Type:  
Pixels Size (XYZ) (µm): 0.2267 x 0.2267  
Z-sections/Timepoints: 1 x 1

+  
👁

Figure 30 – The Image page

The User can press the grey-blue "Eye" icon which displays the List Collection page; the List Collection page shows all the images in the Active collection.

On the Dataset display page, a single Image can be added to the User's active collection, by pressing the green "Plus" button followed by the confirmation pop-up dialogue.

The screenshot shows the top section of the Comparative Pathology Workbench interface. At the top left is the logo with two hands. The main title is "Comparative Pathology Workbench". To the right is a search bar and the user name "mwicks23". Below the title are navigation links: "Benches (4)", "Collections (6)", "Images (25)", "Sources (7)", and "About". A breadcrumb trail shows the path: "/ Sources / mwicks23@CompPathUofE / MVM / Helmsley\_CD".

The main heading is "2021.03.12 - PSR\_healthy\_CD\_ileum". Below it, a dropdown menu indicates "Dataset contains 24 images". The main content area displays a grid of 12 image thumbnails, each with a green plus icon and the text "Add to Active Collection?". Each thumbnail also shows a small image preview and a unique identifier (e.g., "2021.03.12-SR149206...").

At the bottom of the page, there are logos for several partner organizations: HELMSLEY CHARITABLE TRUST, HUMAN CELL ATLAS, THE UNIVERSITY of EDINBURGH, HERIOT WATT UNIVERSITY, Chan Zuckerberg Initiative, and Human Gut Cell Atlas.

Figure 31 – The Dataset page (unfiltered), Top

Also on the Dataset display page, multiple Images can be selected either by individually checking the green Plus check box associated with the Image, or by pressing the red “Tick” icon at the bottom of the page, to select all the Images in the Dataset followed by pressing the separate green “Plus” icon, also at the bottom of the page.

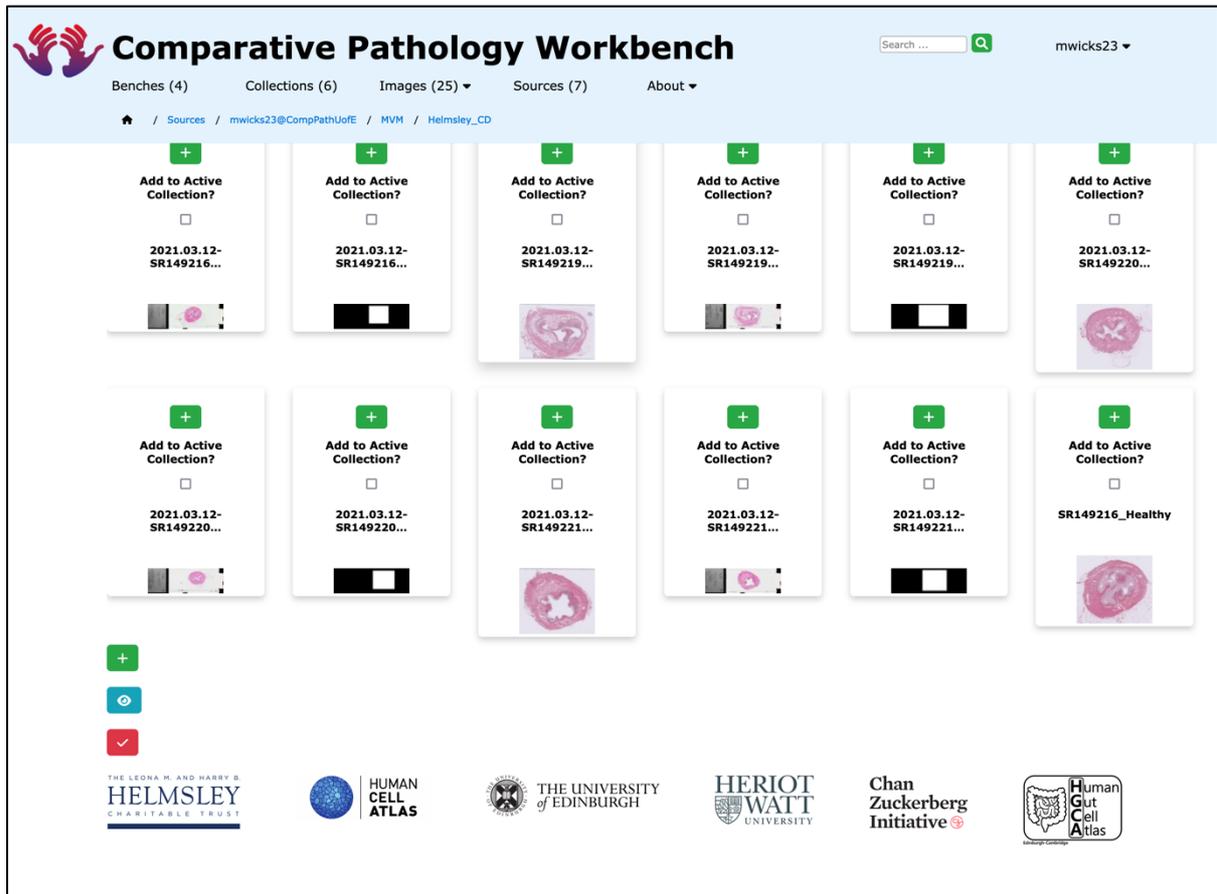


Figure 32 – The Dataset page (unfiltered), Bottom



There is no confirmation dialogue with page-wide green Tick option.

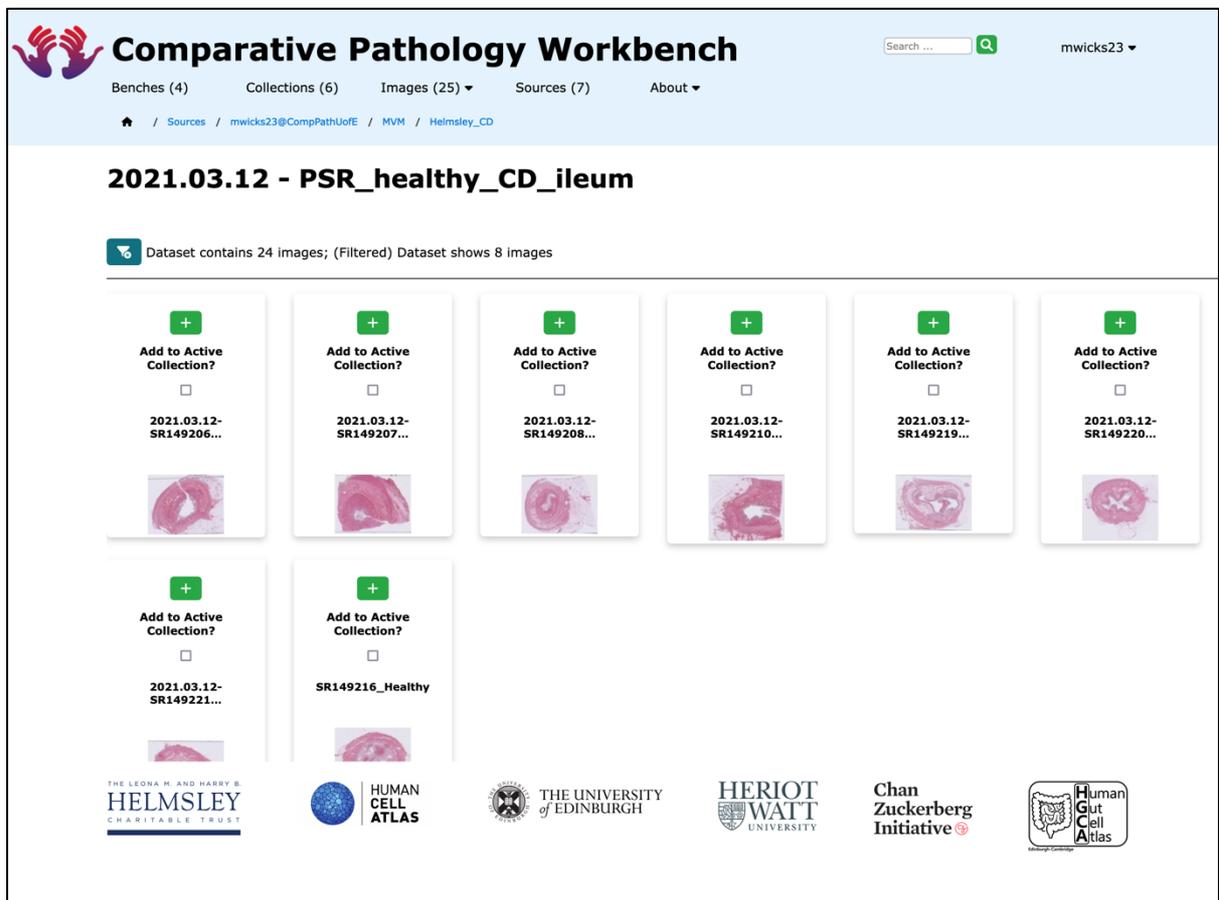
The Dataset page can be “filtered” to show only whole slide images, and not the “Macro” and “Macro Mask” images by pressing the “Filter” button; All images can be viewed by pressing the “Unfilter” button.



The “Filter Dataset” Button.



The “Unfilter Dataset” Button.



**Comparative Pathology Workbench**

Search ...  mwicks23

Benches (4) Collections (6) Images (25) Sources (7) About

2021.03.12 - PSR\_healthy\_CD\_ileum

Dataset contains 24 images; (Filtered) Dataset shows 8 images

8 image cards, each with:

- Green '+' icon
- Text: "Add to Active Collection?"
- Checkbox
- ID: "2021.03.12-SR149206...", "2021.03.12-SR149207...", "2021.03.12-SR149208...", "2021.03.12-SR149210...", "2021.03.12-SR149219...", "2021.03.12-SR149220...", "2021.03.12-SR149221...", "SR149216\_Healthy"
- Thumbnail image

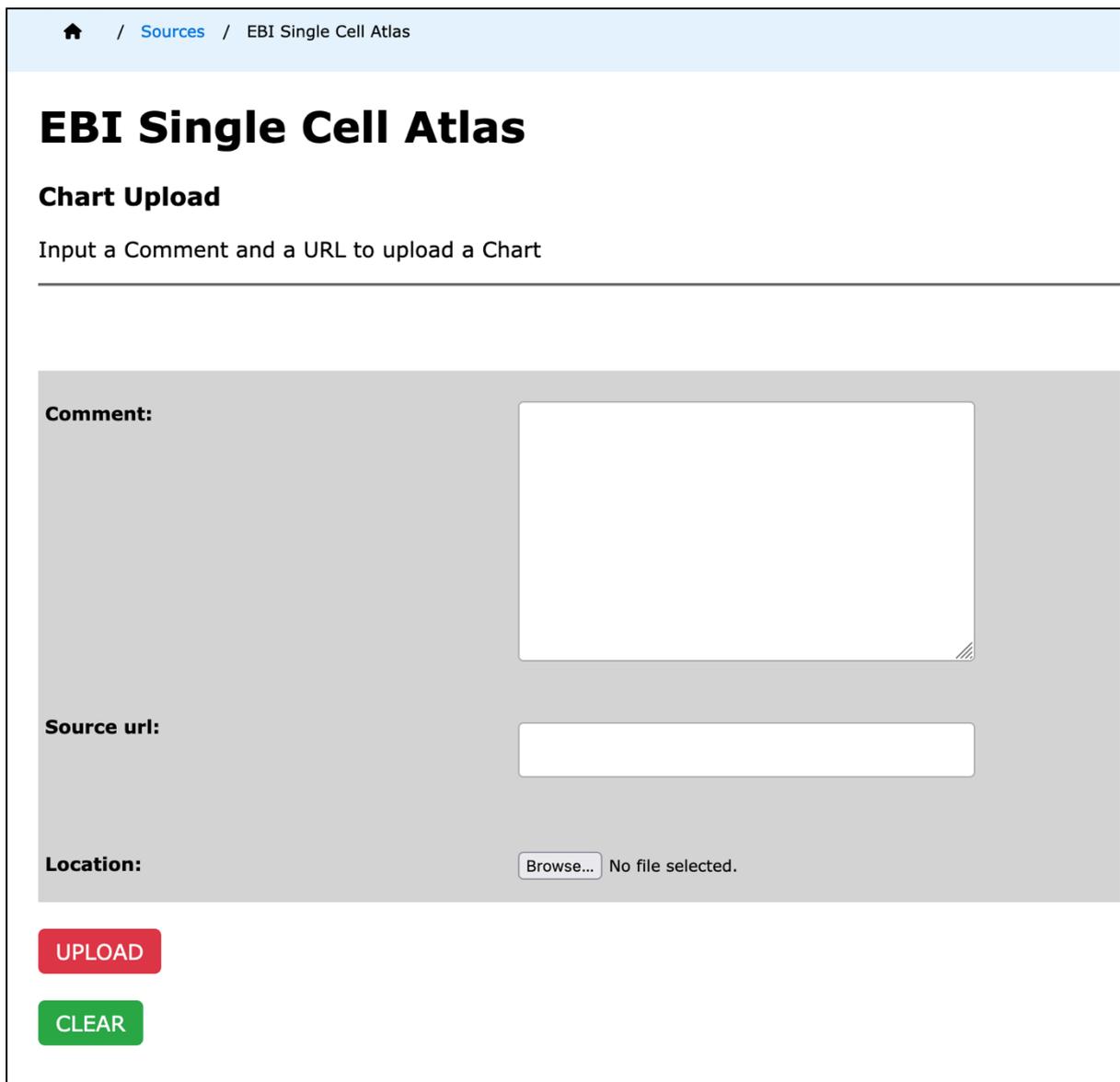
Logos at the bottom: THE LEONA M. AND HARRY B. HELMSLEY CHARITABLE TRUST, HUMAN CELL ATLAS, THE UNIVERSITY OF EDINBURGH, HERIOT WATT UNIVERSITY, Chan Zuckerberg Initiative, Human Gut Cell Atlas

Figure 33 – The Dataset page (filtered), Top

## 5.4.2 EBI SCA Charts

For an EBI SCA source type, the User is presented with a simple input box into which a URL from the EBI SCA must be pasted; along with a Comment box, and a Button to upload the associated chart with.

Pressing the red “Upload” button uploads chart, and this is displayed, together with its associated metadata (reference via the supplied URL).



The screenshot shows a web interface for uploading a chart. At the top, there is a breadcrumb navigation: a home icon, followed by "/ Sources / EBI Single Cell Atlas". Below this is a large heading "EBI Single Cell Atlas" and a sub-heading "Chart Upload". Underneath the sub-heading is the instruction "Input a Comment and a URL to upload a Chart". The main form area has a light gray background and contains three fields: "Comment:" with a large text area, "Source url:" with a single-line text input, and "Location:" with a "Browse..." button and the text "No file selected.". At the bottom of the form are two buttons: a red "UPLOAD" button and a green "CLEAR" button.

Figure 34 – The EBI SCA page

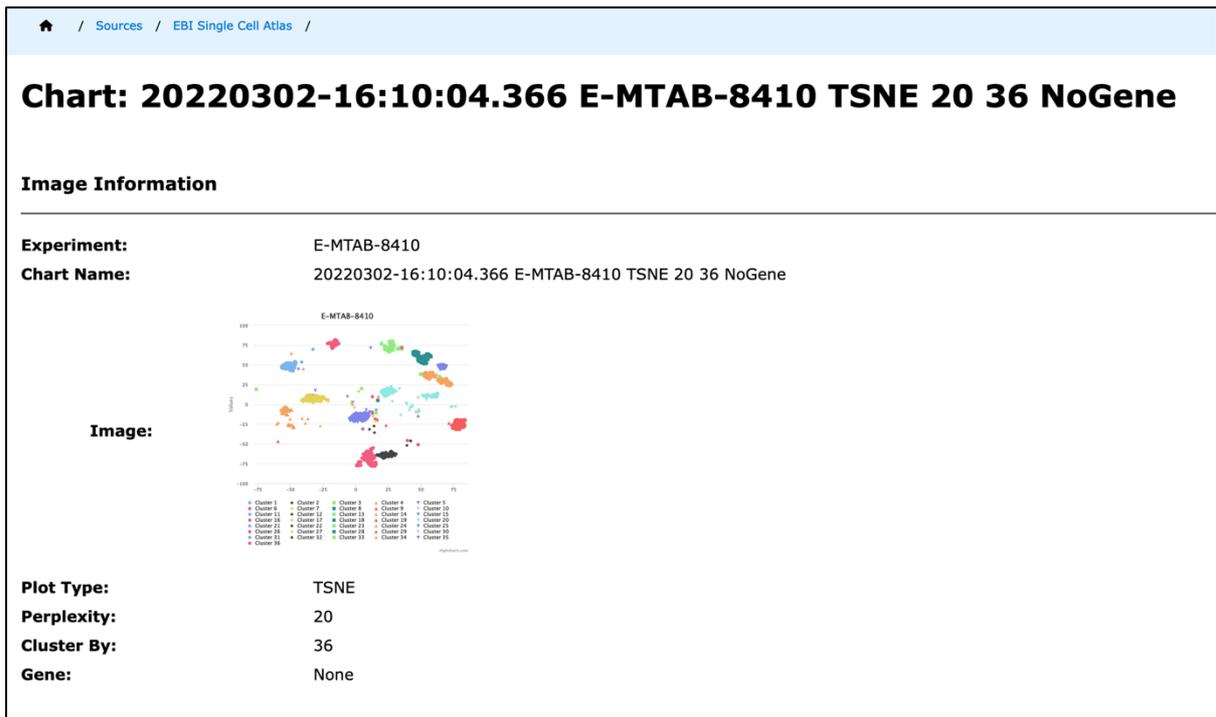


Figure 35.1 – The EBI SCA Chart page

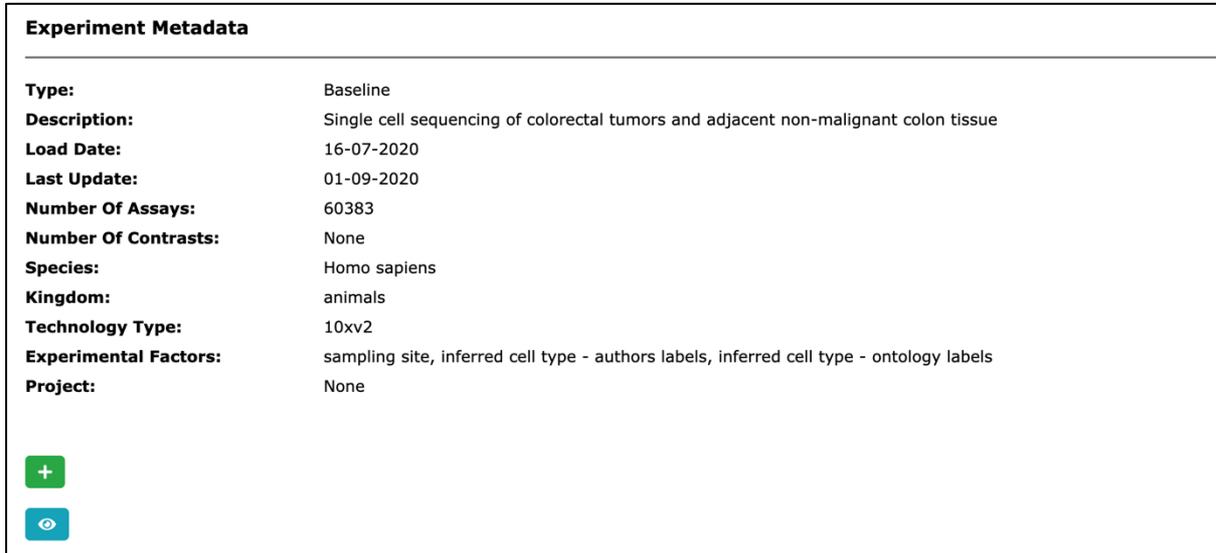


Figure 35.2 – The EBI SCA Chart page

This chart can be added to the User’s active collection, by pressing the green “Plus” button followed by the confirmation pop-up dialogue.

The User can press the grey-green “Eye” icon which displays the List Collection page; the List Collection page shows all the images in the Active collection.

### 5.4.3 WordPress Images

For a WordPress source type, the User is presented with a list of images from the User's WordPress Media Library.

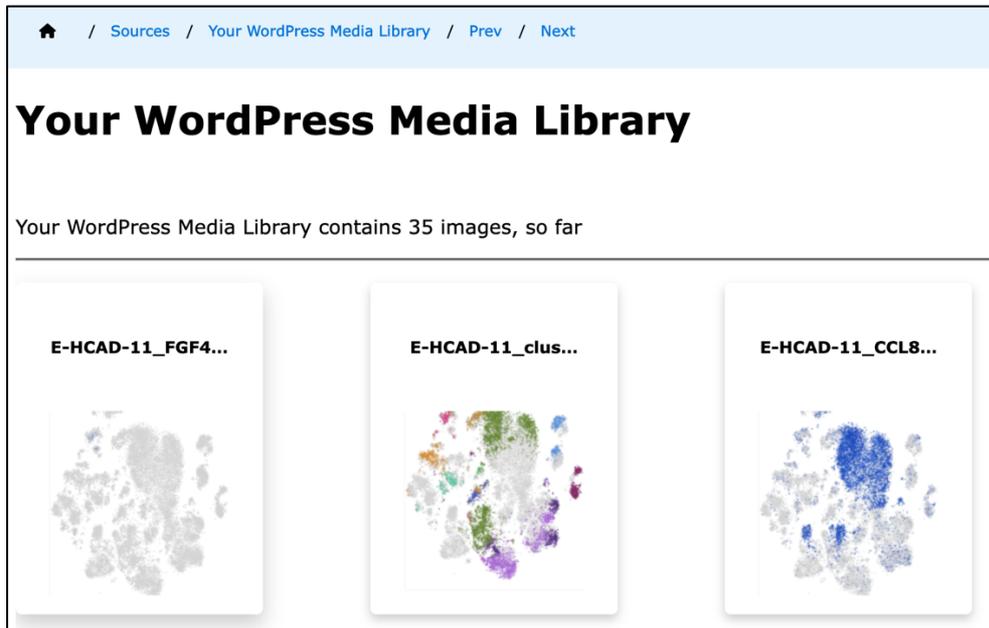


Figure 36 – The WordPress Media Library page

By clicking on an image, the User is presented with the image.

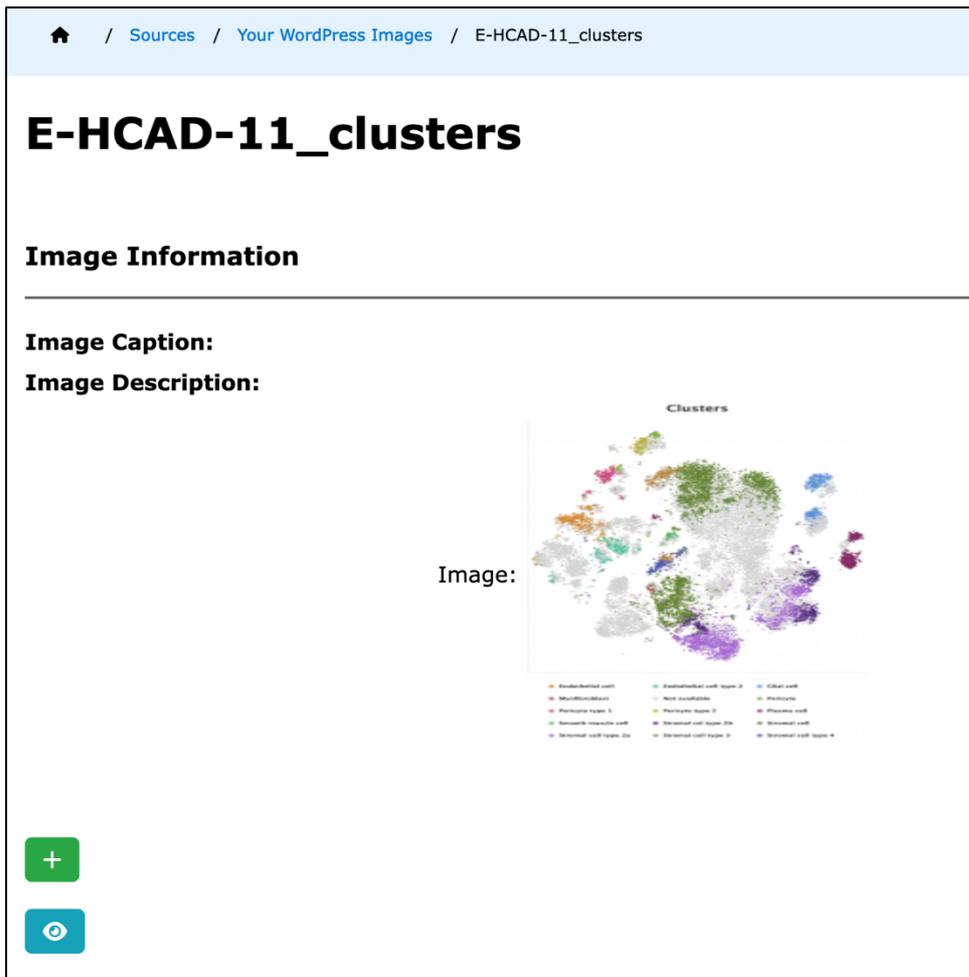


Figure 37 – The WordPress Image page

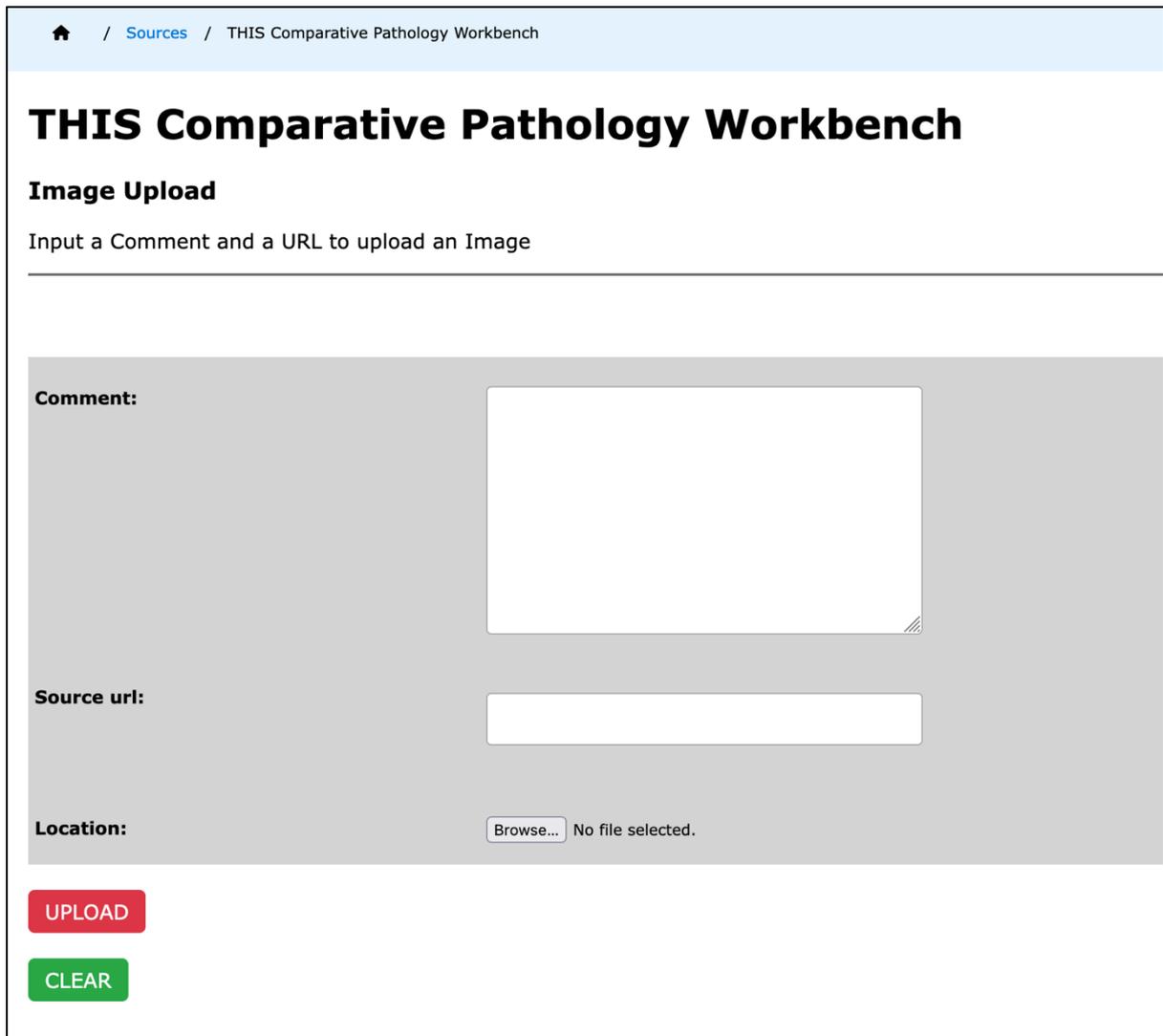
This image can be added to the User’s active collection, by pressing the green “Plus” button followed by the confirmation pop-up dialogue.

On the image page, the User can press the grey-green “Eye” icon which displays the List Collection page, which shows all the images in the Active collection.

#### 5.4.4 CPW Images

For miscellaneous images that come from other source types that are unsupported directly by the CPW, the CPW itself can host images.

The User is presented with a simple input box into which a URL must be pasted; along with a Comment box, and a Button to upload an image with.



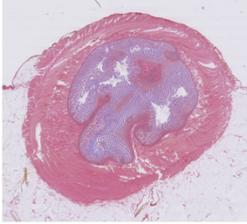
The screenshot shows a web interface for uploading images. At the top, there is a breadcrumb trail: a home icon, followed by "/ Sources / THIS Comparative Pathology Workbench". Below this is a large heading "THIS Comparative Pathology Workbench". Underneath the heading is the section title "Image Upload" and a sub-instruction "Input a Comment and a URL to upload an Image". The main form area has a light gray background and contains three input fields: a "Comment:" field with a large text area, a "Source url:" field with a single-line text input, and a "Location:" field with a "Browse..." button and the text "No file selected.". At the bottom of the form are two buttons: a red "UPLOAD" button and a green "CLEAR" button.

Figure 38 – The CPW Image Upload Page

Pressing the red “Upload” button uploads the image to the CPW, and it is displayed, together with the comment thus:

🏠 / Sources / THIS Comparative Pathology Workbench /

### Image: 20220927-12:50:29.379\_SR149216\_Healthy\_annotated.tif.jpeg



**Image Information**

<b>Image Name:</b>	20220927-12:50:29.379_SR149216_Healthy_annotated.tif.jpeg
<b>Comment:</b>	A healthy, annotated and stained example image
<b>Source:</b>	<a href="https://omero-czi-cpw.mvm.ed.ac.uk/webclient/?show=image-8390">https://omero-czi-cpw.mvm.ed.ac.uk/webclient/?show=image-8390</a>

Figure 39 – An image uploaded to the CPW itself, of an image that has been annotated using QuPath.



The image can be added to the User's active collection, by pressing the green "Plus" button followed by the confirmation pop-up dialogue.



The User can press the grey-green "Eye" icon which displays the List Collection page, which shows all the images in the Active collection.

## 5.5 Creating a Bench

From the Home page, the User must first click on the “Benches” main menu option, or the grey-green “Benches” button in the Home Page “Browse Card”.

A list of the User’s Benches is presented in the “List Benches” page.

**Comparative Pathology Workbench** Search ... mwicks23

Benches (4) Collections (6) Images (25) Sources (7) About

Benches

### Benches

Search the list of Benches

Title: Description: Owner: Authority: Paginate by: 10

Created before: Created after: Modified before: Modified after:

Search Clear

Action	Bench Id	Title	Created On	Updated On	Owner	Authority
	CPW:000016	Test bench for sharing	2020/09/15	2022/09/08	rbaldock	VIEWER
	CPW:000020	Ileum Normal and Crohns	2021/05/17	2022/11/15	mwicks23	OWNER
	CPW:000025	Test for Micheal 25/1/2022	2022/01/25	2022/02/22	rbaldock	EDITOR
	CPW:000030	CPW_Manuscript	2022/09/28	2022/10/28	mglinka	EDITOR

+ Add

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Figure 40 – The Bench List page

The List Benches page provides a search facility for the User to list Benches, depending on the following criteria:

- Title
  - The Title of the Bench contains the supplied sting in the matching text box.
- Description
  - The Description of the Bench contains the supplied sting in the matching text box.
- Owner
  - The Owner of the Bench is chosen from the list of available users.
- Authority

- The Authority assigned to the User over the Bench is chosen from the list of available authorities (“VIEWER” or “EDITOR”).
- Created Before
  - A Date before the Bench was created.
- Created After
  - A Date after the Bench was created.
- Modified Before
  - A Date before the Bench was last modified.
- Modified After
  - A Date after the Bench was last modified.
- Paginate By
  - The Number of Benches to be displayed per Page
    - Use this without any of the other parameters to alter the pagination of the list.



- “<<”
  - Go to the First page
- “<”
  - Go to the Previous page
- <a number>
  - Go to page N
- “>”
  - Go to the Next page
- “>>”
  - Go to the Last page

Each Bench has an associated menu accessed by clicking on the green “hamburger” icon:



Clicking on this green “hamburger” icon shows a menu, thus:

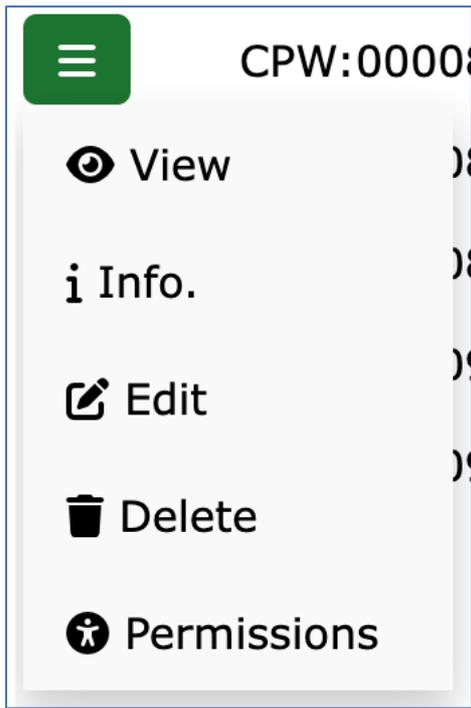


Figure 41 – The List Benches page, Bench Menu

Here the user can do the following:

- View the Bench.
- View the Bench Details (“Info.”)
- Edit the Bench (Details)
- Delete the Bench.
- View the Permissions for the Bench.

At the end of the current page of benches, there is a button to create a new bench:



When a Bench is created a title and description must be supplied; optionally the cell width and height can be specified as well as the number of rows and columns, if the default values are not satisfactory.

On creation the Bench page is displayed.

A typical bench, is displayed in the CPW using the “View” menu option:

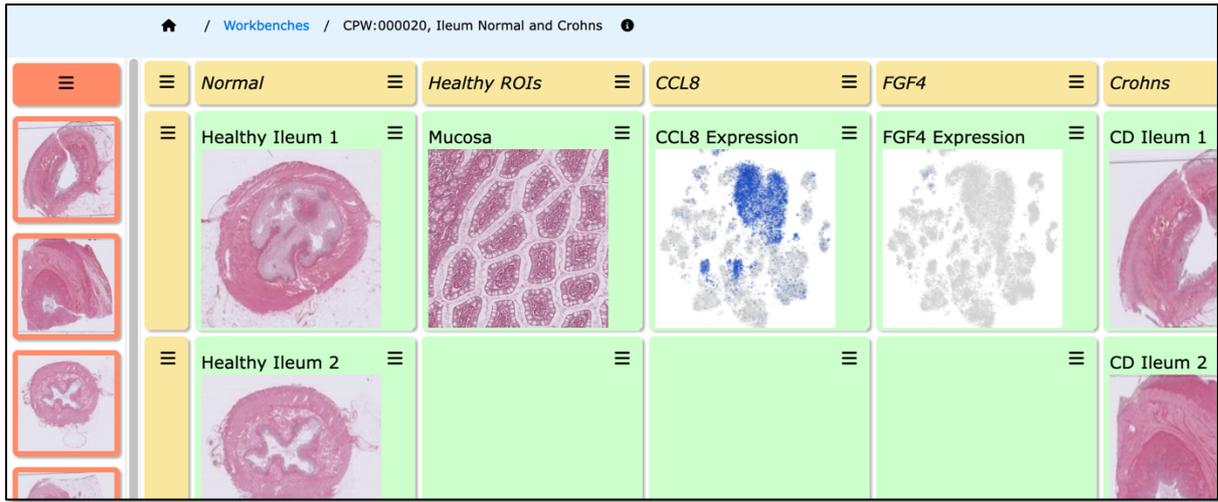


Figure 42 – The Bench page

### 5.5.1 Bench page components

The Bench page consists of 2 panels: the currently Selected Collection is displayed to the immediate left of the page; and the Bench itself to the right of the Active Collection.

Information on the current Bench can be displayed in a pop-up dialogue, by clicking on the bench name in the breadcrumb.

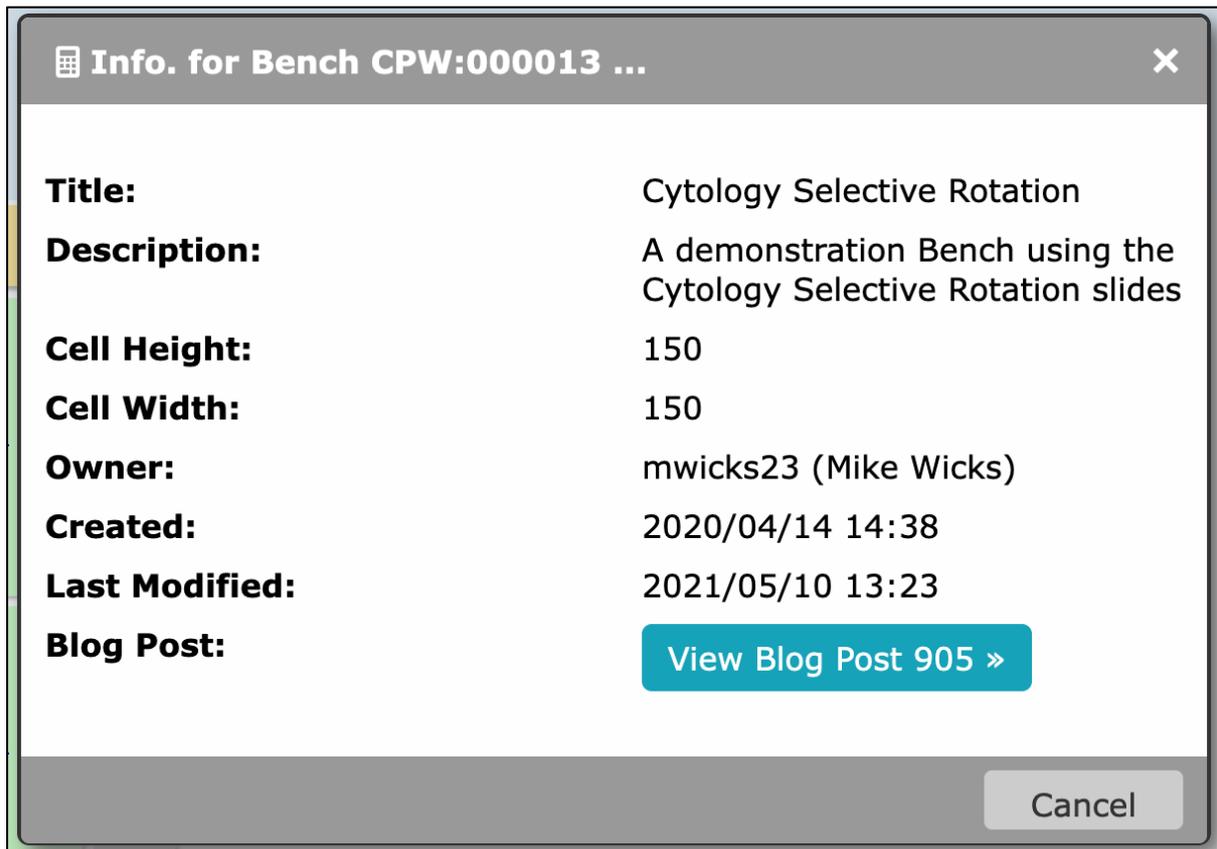


Figure 43 – The Bench Information pop-up dialogue

### 5.5.1.1 The Selected Collection

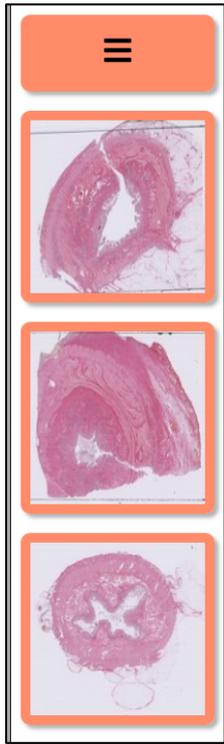


Figure 44 – The Selected Collection on the Bench page

The Selected collection is displayed as a vertical series of orange cells, with a Menu in the topmost orange cell, with each Image from the collection in the orange cells below.

The Collection Panel Menu is accessed by clicking on the “Hamburger” icon (3 short lines), and offers the user to options, “Select Collection” and “View Collection”.

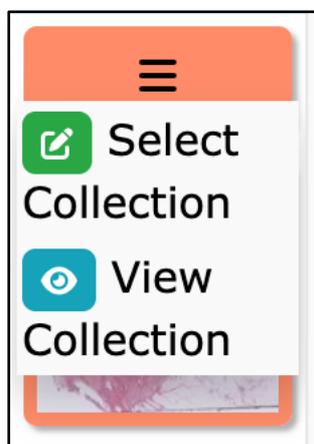


Figure 45 – The Collection Panel Menu

Clicking on “View Collection” will show List Collection page, which lists all the images in the Active Collection.

Clicking on “Select Collection” will show a pop-up menu, offering the user the chance to select an alternative collection to use with this bench, thus:

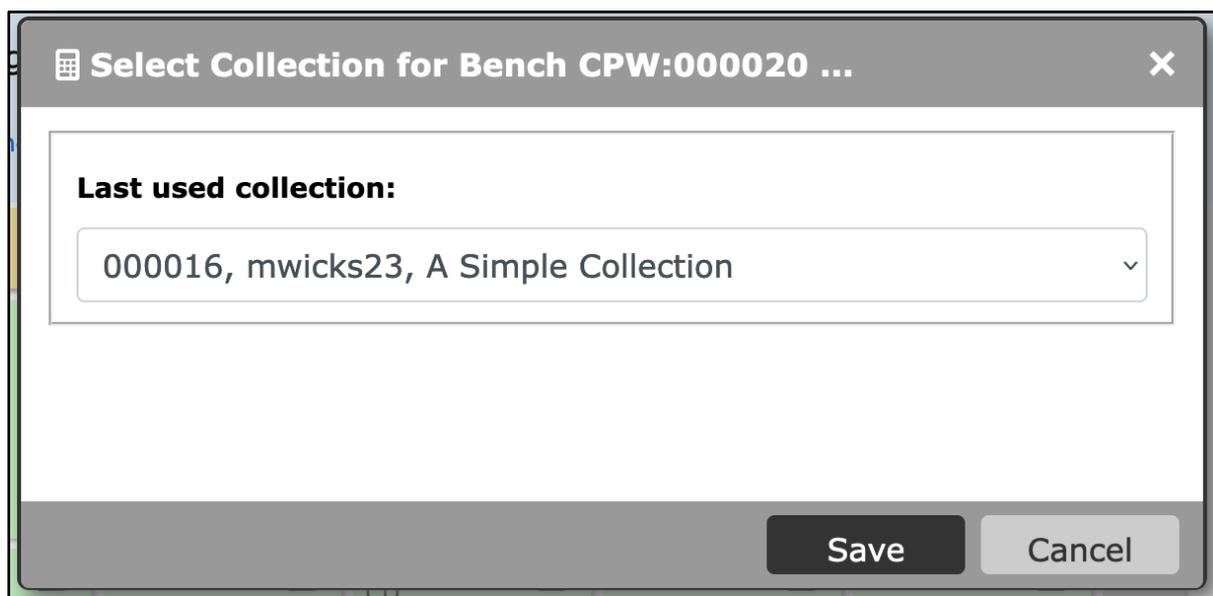


Figure 46 – The Collection Selection Pop-up

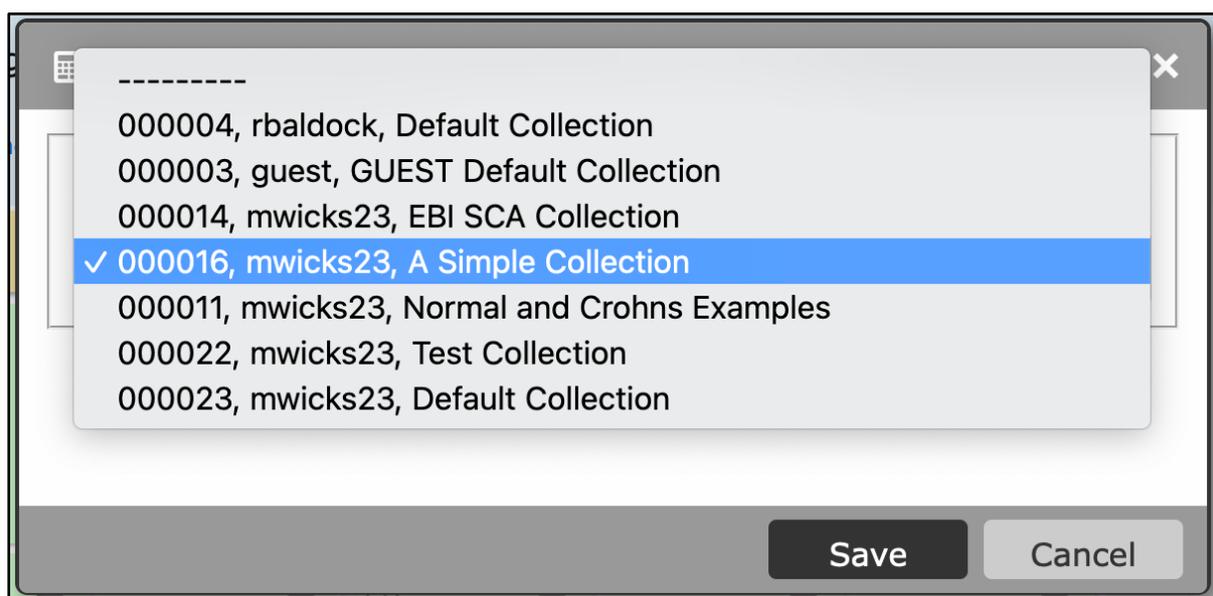


Figure 46.5 – Selecting an alternative Collection

### 5.5.1.2 The Bench

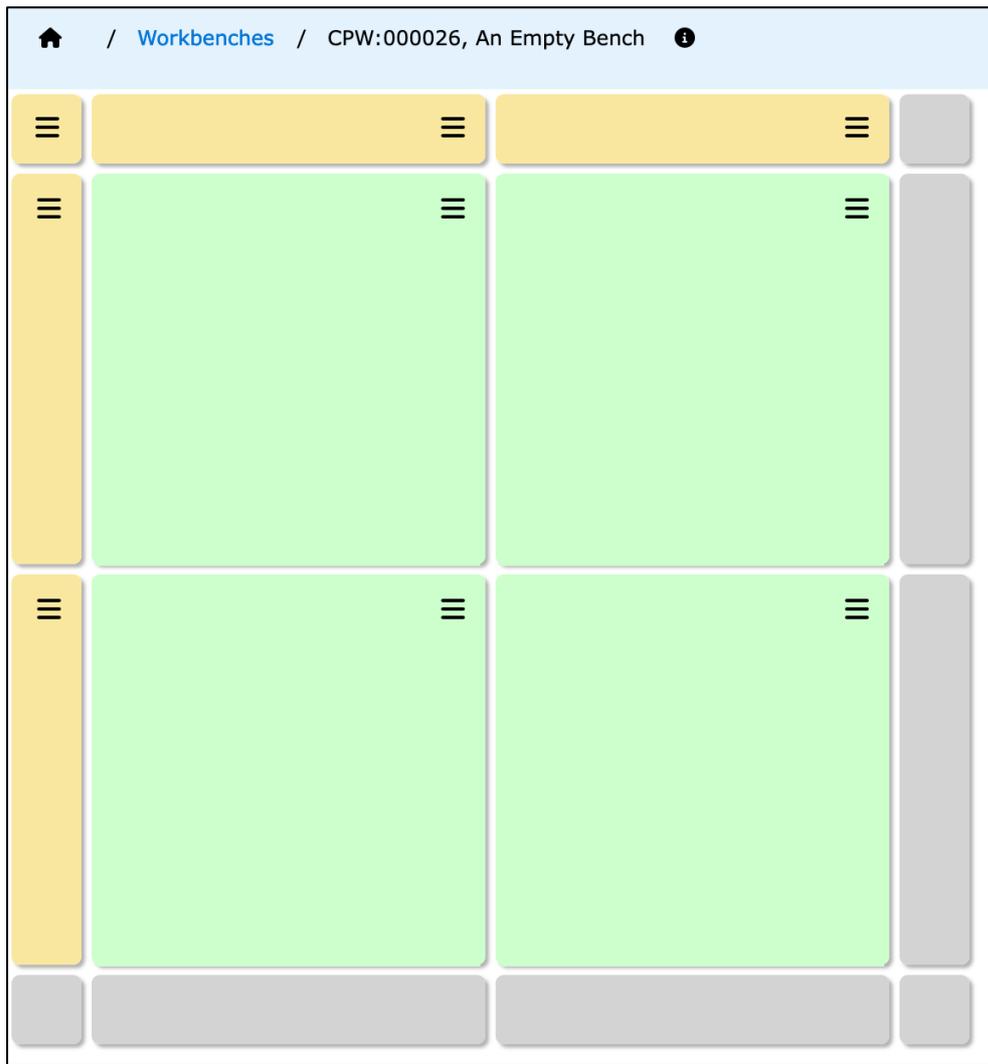


Figure 47 – An initial Bench, created using the system provided defaults

There are 4 types of Cell that make up a Bench:

- A Yellow “Master” cell,
- Yellow column and row “Header” cells,
- Grey “Footer” cells and,
- Green “Ordinary” cells.

#### 5.5.1.2.1 The Master Cell



Figure 48 - The Master Cell

The “Master” cell provides the main control functions for the Bench, with these available via the master cell menu;

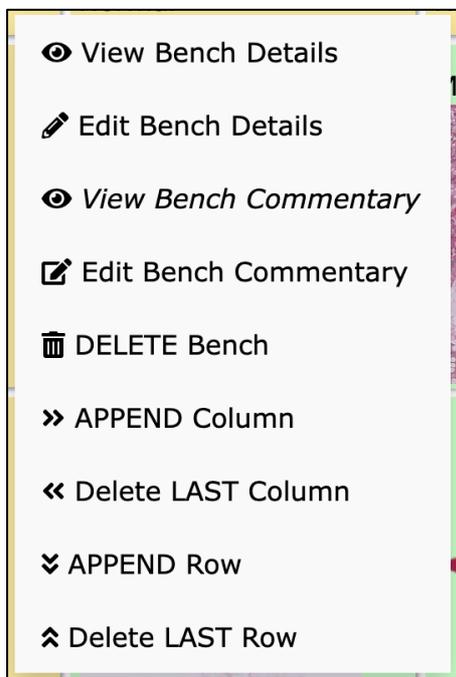


Figure 49 – The Master Cell Menu Items

The menu is accessed by clicking on the “Hamburger” icon, and offers the following functions:

- View Bench Details
  - Shows the information about the Bench, as provided on creation or at last edit.
- Edit Bench Details
  - Allows the Bench parameters to be edited.
- View Bench Commentary
  - Displays a pop-up window with a summary of the commentary stored for this Bench.
- Edit Bench Commentary
  - Displays a page in a separate tab, to allow more commentary to be added to the Bench Commentary.
- Delete Bench
  - Deletes the Bench after a confirmatory dialogue.
- Append Column
  - Adds a new column of cells after the right most column.
- Delete Last Column
  - Deletes the right most column of cells after a confirmatory dialogue.
- Append Row
  - Adds a new row of cells after the bottom most row.
- Delete Last Row
  - Deletes the bottom most row of cells after a confirmatory dialogue.

#### 5.5.1.2.2 Row and Column Header Cells

Row and Column Header cells provide row and column level functions, as well as allowing the User to label Rows and Columns of Ordinary cells, with a Title and Description, as required.



Figure 50 – A Column Header Cell

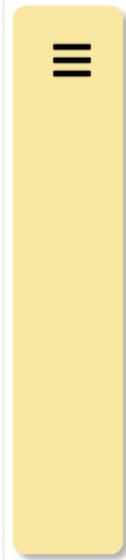


Figure 51 – A Row Header Cell

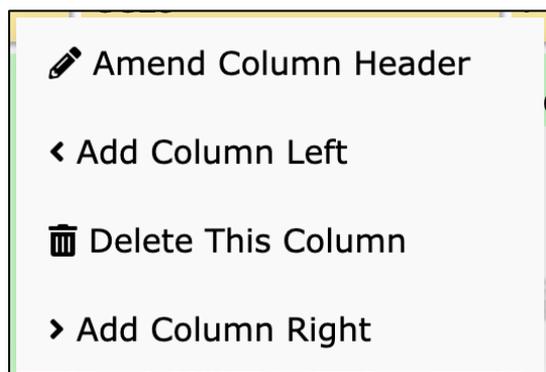


Figure 52 – Column Header Menu Items

The menu is accessed by clicking on the “Hamburger” icon, and offers the following functions:

- Amend Column Header
  - Allows a Column Title and Description to be added.
- Add Column Left
  - Adds a new column of cells to the immediate left of this column.
- Delete this Column
  - Deletes this column of cells after a confirmatory dialogue.
- Add Column Right
  - Adds a new column of cells to the immediate right of this column.

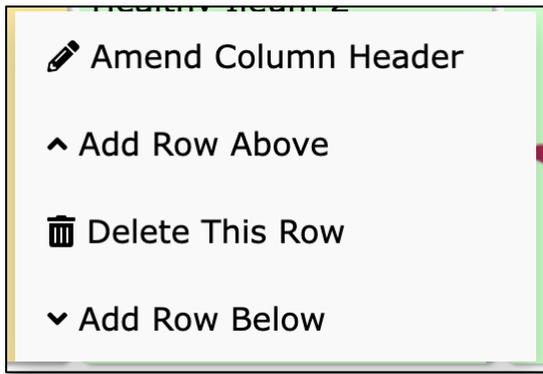


Figure 53 – Row Header Menu Items

The menu is accessed by clicking on the “Hamburger” icon, and offers the following functions:

- Amend Row Header
  - Allows a Row Title and Description to be added.
- Add Row Above
  - Adds a new row of cells to the immediately above this row.
- Delete this Row
  - Deletes this row of cells after a confirmatory dialogue.
- Add Row Below
  - Adds a new row of cells to the immediately below this row.

#### 5.5.1.2.3 Footer Cells

Footer cells are simply place holder cells, that provide “targets” for the dropping of dragged cells. Green “Ordinary” cells can be dragged and dropped to expand the Bench, in addition to the functions available in the master cell, column header cells and row header cells.

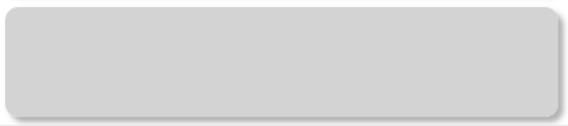


Figure 54 – A Column Footer Cell

Dragging a green “ordinary” cell onto a column footer cell, adds a row to the Bench.



*Figure 55 – A Row Footer Cell*

Dragging a green “ordinary” cell onto a row footer cell, adds a column to the Bench.

#### 5.5.1.2.4 Ordinary Cells

The following is an example of an Ordinary Cell that is empty:



Figure 56 – An “ordinary” empty Bench Cell

The following is an example of an Ordinary Cell that contains a reference to an image:



Figure 57 – An “ordinary” Bench Cell with a reference to an image

The following is an example of an Ordinary cell that contains a reference to an image, and that image has a “link” to another image referenced in the CPW:

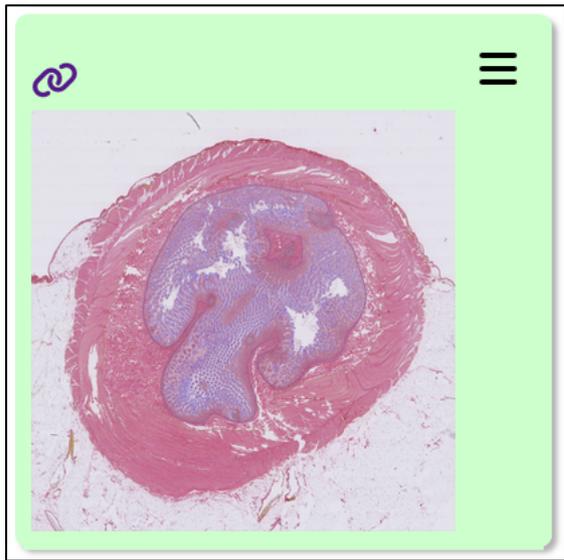


Figure 58 – An “ordinary” Bench Cell with a reference to a “linked” image

See section on “Linking Images” for further instructions on creating associations between images.

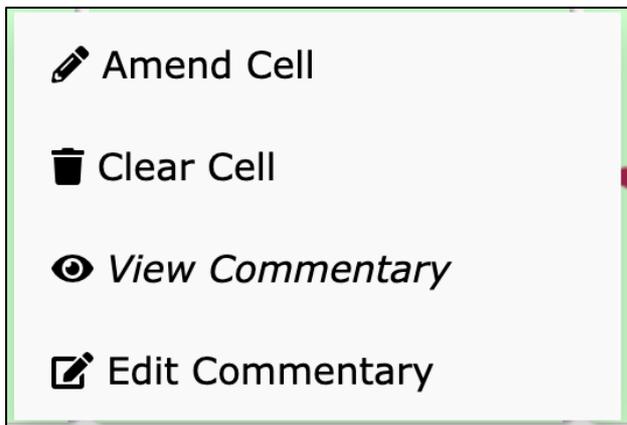


Figure 59 – An “ordinary” Bench Cell Menu

The menu is accessed by clicking on the “Hamburger” icon, and offers the following functions:

- Amend Cell
  - Displays the Amend Cell page.

- Clear Cell
  - If there is an image associated with the cell, this option allows the cell to be emptied with the image returning to the active collection.
- View Commentary
  - Displays the cell commentary as a Pop-up dialogue.
- Edit Commentary
  - Displays the Edit Cell Commentary page, to allow more commentary to be added to the Cell Commentary.

## 5.6 Adding an Image to a Bench

There are 2 ways to add an image to a Bench cell:

1. Bench Page Drag'n'Drop
2. Edit Cell Page Drag'n'Drop

### 5.6.1 Bench Page Drag'n'Drop

The Bench page displays the currently active Collection and the Bench; Images can be dragged from the Collection to ordinary green cells in the Bench.

The User is prompted to "Import" the image, or "Close" the dialogue – Import being a confirmation, Close cancels the import.

### 5.6.2 Edit Cell Page Drag'n'Drop

**Comparative Pathology Workbench** Search ... mwicks23

Benches (4) Collections (6) Images (25) Sources (7) About

Home / Benches / CPW:000020 / Edit Cell

### CELL - CPW:000020\_581, "Ileum Normal and Crohns"; Column 6, Row 1

Amend the Cell Details

Url string:

**UPDATE** **CLEAR**

**Title:** 20220927-13:19:25.772\_SR149216\_Healthy\_annotated.tif.jpeg  
**Description:** 20220927-13:19:25.772\_SR149216\_Healthy\_annotated.tif.jpeg  
**Image Name:** 20220927-13:19:25.772\_SR149216\_Healthy\_annotated.tif.jpeg  
**Blog Post:** [View Blog Post 4115 >](#)

**Clear Cell:**

**View Bench:**

**Link as Image A:**

**Link as Image B:**

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Figure 60 – The Edit Cell page

On the Edit Cell page it is also possible to update a cell by Drag and Drop. Here, the user can drag an image from the Active Collection onto the single Green Cell.

More precise control of Title, Description and Image Name is available on this page, than the Bench Page Drag and Drop option that updates a cell.



The Cell Title and Description can be amended by hovering over each, and clicking on the “pencil” icon.

A URL Box and update button is provided as well, should the User want to use a URL (eg. cut and paste the “Link To this Image” URL from the OMERO Webclient) from an OMERO server to update the cell directly.

### 5.6.3 Moving Cells within a Bench

In addition, Cells can be moved by “Drag and Drop” to rearrange the Bench.

An ordinary green Bench cell can be dragged and dropped onto another ordinary cell, with a confirmatory dialogue prompt.

The User is prompted to “Swap”, “Cut”, “Copy” the cell, or “Close” the dialogue.

- “Swap”
  - simply swaps around the source and target cells;
    - Eg. For a source Cell A at X1, Y1 and a target Cell B at X2, Y2, “Swap” moves Cell A to X2, Y2, and Cell B to X1, Y1.
- “Cut”
  - moves the source cell to the target cell, overwrites the target cell, and empties the source cell;
    - Eg. For a source Cell A at X1, Y1, and target Cell B at X2, Y2, “Cut” moves Cell A to X2, Y2, and the contents of the Cell at X1, Y1 is cleared.
- “Copy”
  - moves the source cell to the target cell, overwrites the target cell, but leaves the source cell in place;
    - Eg. For a source Cell A at X1, Y1, and target Cell B at X2, Y2, “Copy” moves Cell A to X2, Y2, and keeps the same contents as Cell A in the Cell at X1, Y1.
  -
- “Close”
  - cancels the import.

Dragging an ordinary green cell to a grey row footer cell will expand the Bench by another row, without a confirmatory dialogue.

Dragging an ordinary green cell to a grey column footer cell will expand the Bench by another column, without a confirmatory dialogue.

## 5.7 Adding Commentary

Commentary can be added to a cell or the Bench in general, by the Edit Commentary or Edit Bench Commentary Menu options.

The screenshot shows a web interface for editing bench commentary. At the top, there is a breadcrumb trail: / Workbenches / CPW:000020 / Bench Commentary. Below this is the title "CPW:000020, 'Ileum Normal and Crohns'" and a sub-section "Bench Commentary". A link "Browse the Bench Commentary" is provided. The main content is a table with two sections: "Post" and "Comment".

Date	Time	Author	Post	Action
2021-05-17	13:49:37	mwicks23	Example Images from both Normal Ileum and Crohns Diseased Ileum	<a href="#">View</a>

Date	Time	Author	Comment	Action
2021-06-01	09:55:27	marends	Normal terminal ileum section shows normal lymphoid aggregates as Mucosa Associated Lymphoid Tissue (MALT) usually located spanning both mucosa and submucosa. No abnormal inflammatory cell infiltrates.	<a href="#">View</a>
2021-06-01	09:57:01	marends	Ileum with Crohn's disease shows moderate to marked fibrosis involving mostly submucosa and serosa and also some increased fibrosis in the muscularis propria and in the (partly ulcerated) mucosa.	<a href="#">View</a>

Below the table is a "Post a Comment:" section with a "Comment:" label, a text input field, and a "Required." note. At the bottom of this section are two buttons: a red "COMMENT" button and a green "Back" button.

Figure 61 – The Edit Bench Commentary page



Figure 62.1 – The Edit Cell Commentary page

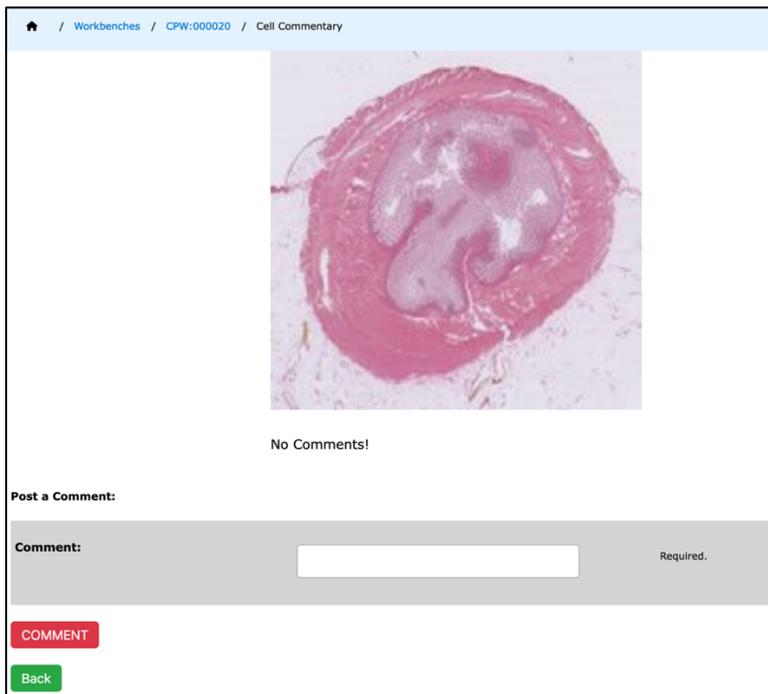


Figure 62.2 – The Edit Cell Commentary page

The User simply adds their comment in the grey box and presses the read "Comment" button. The page is updated in place.

These 2 pages are displayed in new separate browser tabs, to allow the user to easily reference the Bench as a whole on the previous tab, while adding a new comment to the commentary.

Closing these extra tabs is recommended after update, together with a refresh of the original Bench page.

## 5.8 A Quick Search for a Bench



Figure 63 – Main Menu Header Search Box

In the Main Header panel, there is a simple text search box, which takes the supplied (case sensitive) text and returns a list of Benches, whose title, description, owner or authority contains the supplied string, to which the current User has access.

## 5.9 Sharing

Benches and Collections can be shared between Users.

All data is owned by an individual User, and that user can determine who can view or edit their data, be it a Bench or a Collection.

A User can add permissions for other users to view or edit a Bench owned by the User.

A User can add permissions for other users to view a Collection owned by the User.

### 5.9.1 Sharing a Bench

The List Benches page provides a sharing facility for the User to share a Bench

Pressing the “Permissions” option on the Bench drop down menu, displays the Browse Bench Permissions page for that Bench.

**Comparative Pathology Workbench**

Benches (4) Collections (6) Images (25) Sources (7) About

Search ... mwicks23

Home / List Benches / Permissions for Bench CPW:000020

### Browse Permissions for Bench CPW:000020

Browse the list of Permissions for Bench CPW:000020

Action	Bench	Owner	Permitted	Authority
	CPW:000020	mwicks23	marends	EDITOR
	CPW:000020	mwicks23	rbaldock	EDITOR
	CPW:000020	mwicks23	guest	VIEWER
	CPW:000020	mwicks23	mglinka	EDITOR

Logos: HELMSLEY CHARITABLE TRUST, HUMAN CELL ATLAS, THE UNIVERSITY OF EDINBURGH, HERIOT WATT UNIVERSITY, Chan Zuckerberg Initiative, Human Gut Cell Atlas

Figure 64 – The Browse Bench Permissions page

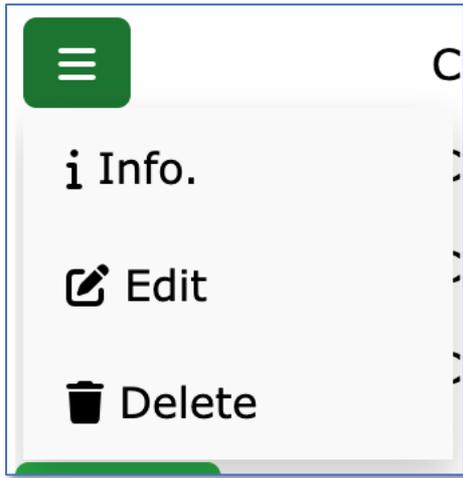


Pressing the green “Plus” icon, allows the User to add new permission for other Users.

The Browse Bench Permissions page allows the CPW user add a new permission via a pop-up dialogue. This pop-up dialogue allows the user to choose a bench from a drop-down list of their collections, a user they wish to grant a permission to from a second drop-down, and an authority level they wish to grant from a third and final drop-down (Viewer or Editor).

The Browse Bench Permissions page for that Bench is updated with a new Permission, specifying the Bench Title and ID, Owner (the User), Permitted (who this permission has been granted to), and to what Authority (“Viewer” or Editor).

Each Bench Permission has a Green “hamburger” icon that displays a menu with options for managing the Bench Permission:



*Figure 65 – The Browse Bench Permissions page, Permissions Menu*

Here the user can do the following:

- View the Bench Permission Details.
- Edit the Bench Permission Details.
- Delete the Bench Permission.

All the Bench Permissions of the User can be accessed from the User Main Menu option in the Main Header Panel.

## 5.9.2 Sharing a Collection

The List Collections page provides a sharing facility for the User to share a Collection

Pressing the “Permissions” option on the Collection drop down menu, displays the Browse Collection Permissions page for that Collection.

**Comparative Pathology Workbench**

Benches (4) Collections (6) Images (25) Sources (7) About

Search ... mwicks23

Home / List Collections / Permissions for Collection:000011

### Browse Permissions for Collection:000011

Browse the list of Permissions for Collection:000011

Action	Collection	Owner	Permitted	Authority
	000011	mwicks23	marends	VIEWER

[+ Add](#)

THE LEONA M. AND HARRY B. HELMSLEY CHARITABLE TRUST | HUMAN CELL ATLAS | THE UNIVERSITY OF EDINBURGH | HERIOT WATT UNIVERSITY | Chan Zuckerberg Initiative | Human Glut Cell Atlas

Figure 66 – The Browse Collection Permissions page

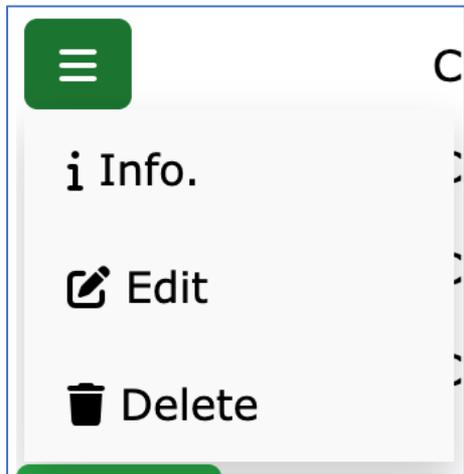


Pressing the green “Plus”, allows the User to add new permission for other Users.

The Browse Collection Permissions page allows the CPW user add a new permission via a pop-up dialogue. This pop-up dialogue allows the user to choose a Collection from a drop-down list of their collections, a user they wish to grant a permission to from a second drop-down, and an authority level they wish to grant from a third and final drop-down (for Collections only the View permission is available).

The Browse Collection Permissions page for that Collection is updated with a new Permission, specifying the Collection Title and ID, Owner (the User), Permitted (who this permission has been granted to), and to what Authority (“Viewer” only for Collections).

Each Collection Permission has a Green “hamburger” icon that displays a menu with options for managing the Collection Permission:



*Figure 67 – The Browse Collection Permissions page, Permissions Menu*

Here the user can do the following:

- View the Collection Permission Details.
- Edit the Collection Permission Details.
- Delete the Collection Permission.

All the Collection Permissions of the User can be accessed from the User Main Menu option in the Main Header Panel.

## 5.10 Linking Images

In addition to aggregating images into Collections and displaying references to images in Benches, the CPW can also store links between images too.

For example, the following screen shows the relationship between 2 Images, with Image B an annotated version of Image A, as processed by QuPath, the Quantitative Pathology & Bioimage Analysis software ( <https://qupath.github.io/> )

The screenshot displays the 'Comparative Pathology Workbench' interface. At the top, there is a navigation bar with the logo, search bar, and user profile 'mwicks23'. Below the navigation bar, the breadcrumb trail reads: 'ALL Image Links / Link Images / An Image Link / 4'. The main content area is titled 'Image Link 4' and contains two image thumbnails, 'Image A' and 'Image B', both showing histological sections of tissue. Below each image is a small blue information icon. To the right of the images is a 'Supplementary Information' box containing the following text: 'Comment: Image B has been annotated using the QuPath software from Image A', 'Uploaded: Sept. 27, 2022, 1:22 p.m.', and 'Attachment: [20220927-13:22:53.527\\_test.txt.zip](#)'.

Figure 68 – 2 Linked Images

The Link between 2 images is stored with a comment that justifies the link, a date when the link was made, and a file attachment (a Zipfile), that contains a justification for the link.

All the Images that have been linked can be viewed using the “All Your Image Links” sub-menu option from the “Images” main menu, thus:

**Comparative Pathology Workbench**

Benches (12) Collections (10) Images (96) Sources (8) About

Search ... mwicks23

ALL YOUR Image Links / Link Images

### All YOUR Image Links

You can view 1 Image Links from 10 Collections

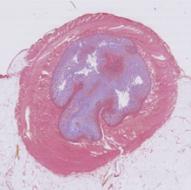
Action	Image A	Image B	Upload Time	Attachment	Comment
 			Sept. 27, 2022, 1:22 p.m.	<a href="#">20220927-13:22:53.527_test.txt.zip</a>	Image B has been annotated using the Qu

Figure 69 – A list of all Your Linked Images

Images can be linked using the “Link Images” breadcrumb, which displays the Link Images page, thus:

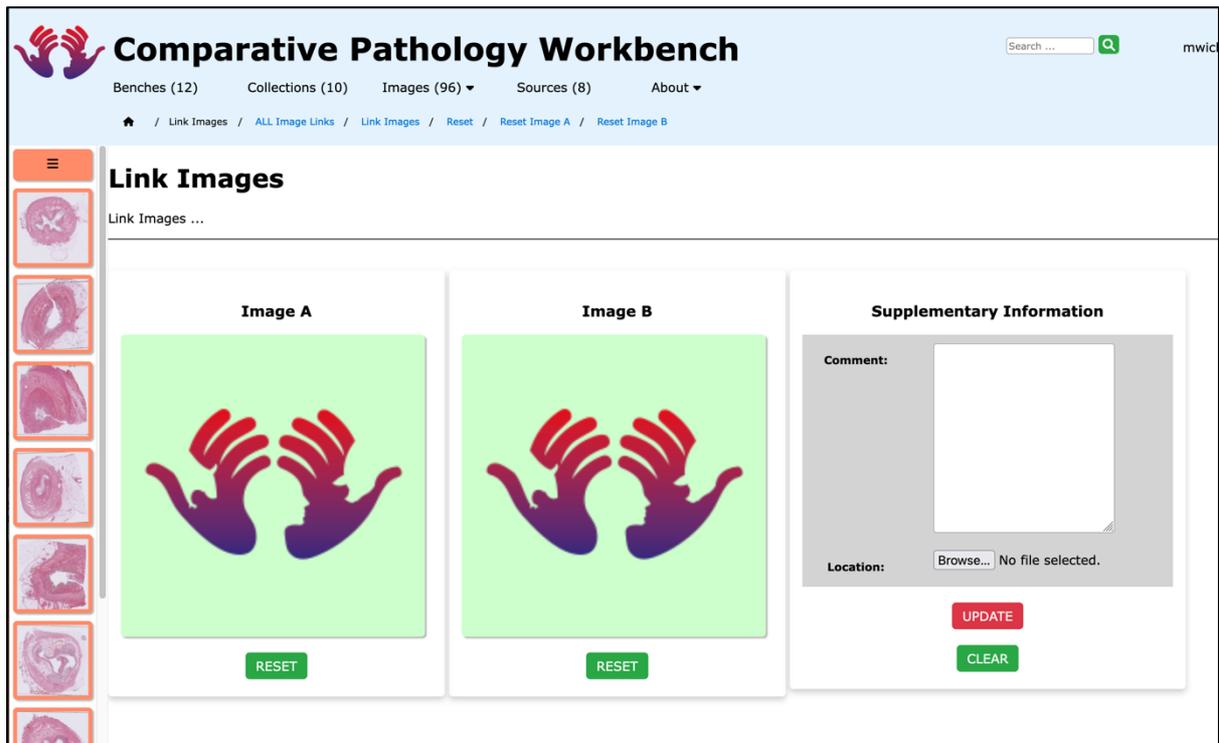


Figure 70 – Link Images

2 Images can be dragged from the Collection on the LHS of the screen, in to Image A or Image B; the user must supply a justification in the Comment Box, and a file must be supplied via the Location button, as a Zipfile.

Typically, the Zipfile may contain a set of files that explain the link between the 2 images. In the case of Figure 52, the Zipfile could contain all of the annotations and scripts that QuPath generated to produce Image B from Image A, for example.

### 5.10.1 Displaying Linked Images

The existence of a linked image is indicated throughout the CPW by the presence of the “Chain” icon:



This is displayed on all Image list pages, such as “View All Collections”, “View Active Collection” and “View Collection”, thus:

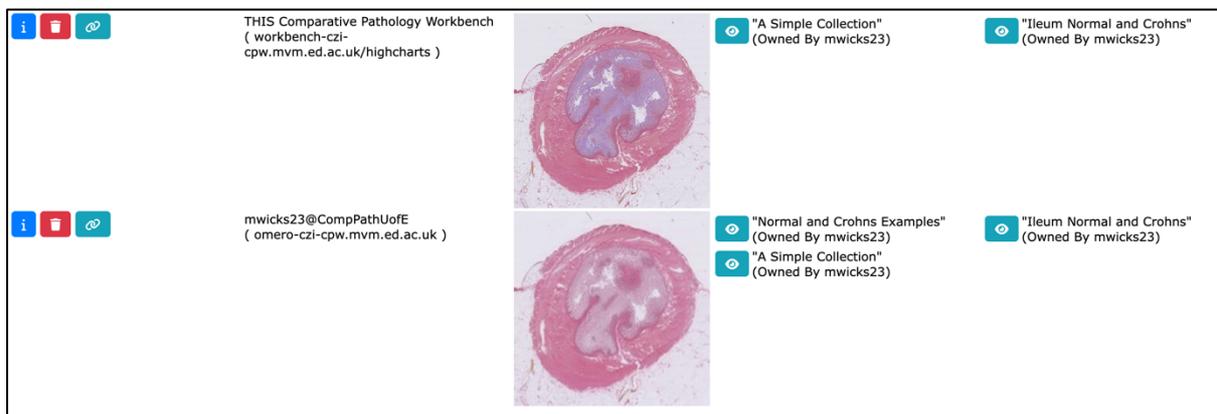


Figure 71 – 2 Images that have links associated with them

Clicking on the Chain icon takes the user to the “View Image Link” page, in Figure 52.

If an image is referenced in a Bench, then the image title in the cell is replaced with a Chain icon, thus:



*Figure 72 – a Linked Image in a Bench Cell*

Again, clicking on the Chain icon takes the user to the “View Image Link” page, in Figure 52.

## **6 A Final Word ...**

If there are any omissions and errors in this User Guide, please get in touch!

Mike Wicks

[mwicks23@ed.ac.uk](mailto:mwicks23@ed.ac.uk)

Web Programmer for Helmsley Charitable Trust Human Gut Cell Atlas Project

<https://www.ed.ac.uk/pathology/people/staff-students/mike-wicks>

<https://www.ed.ac.uk/comparative-pathology/the-gut-cell-atlas-project>

16<sup>th</sup> November 2022