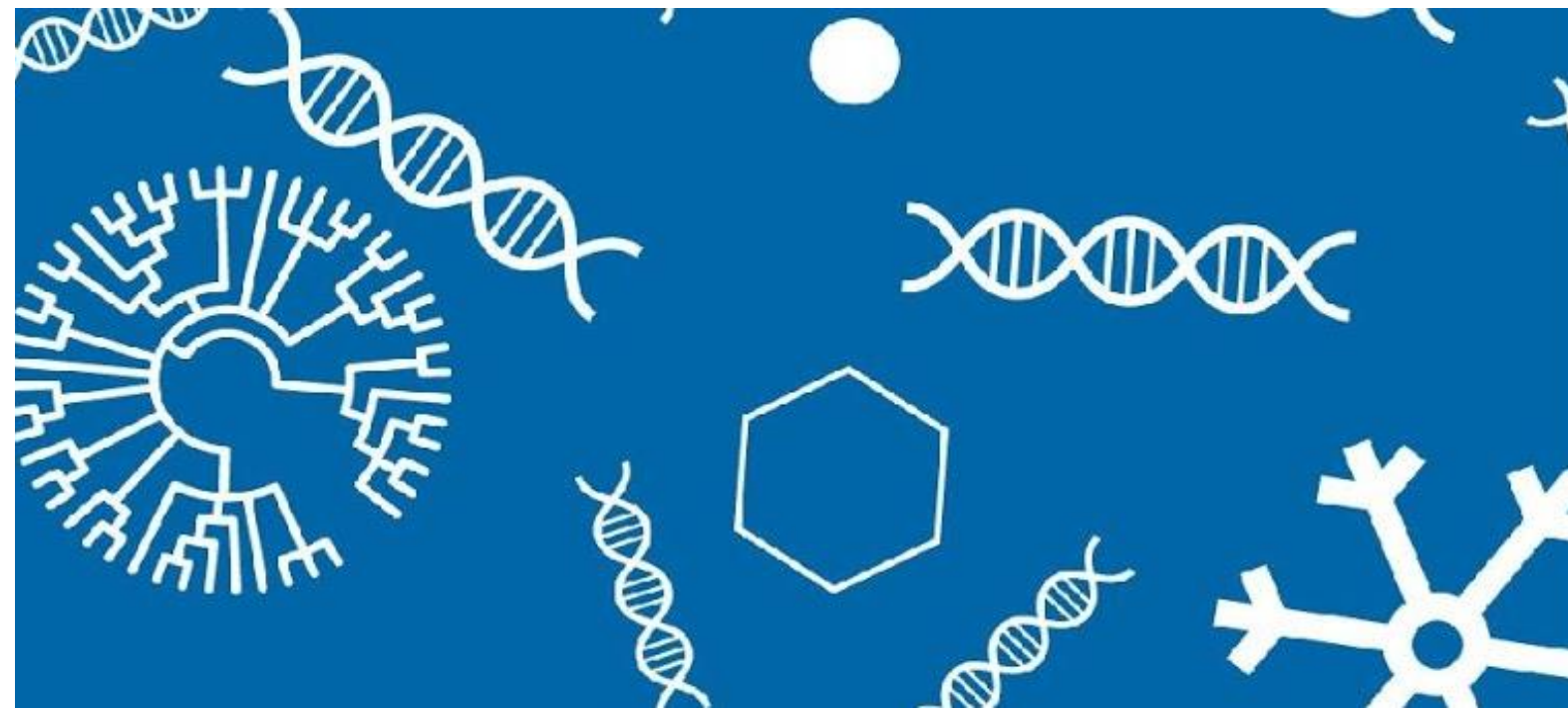




ENHANCING FROZEN COLLECTIONS ACROSS THE UK



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Training Your Team To Conduct An Inventory Of Your Sample Collection

Written by Kirsty Lloyd, BBSRC CryoArks Technician

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Product of CryoArks Partner:



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Conducting an inventory

For the purposes of this document we define an inventory as an itemized list of samples that you hold complete with their associated metadata. An inventory provides the collections/laboratory manager with essential information on the breadth and depth of a collection. Those samples that are sat at the back of your freezers and are currently not being used, could help support new research. Therefore, conducting an inventory is a key first step to realising your collection's potential.

An inventory should be able to tell you what you have and where is it in the freezers. In its most basic form it may not list every individual sample, but contain an overview of groups of samples (e.g. from a specific location, research project or donation). A complete inventory would include all metadata associated with each sample (the location the animal was collected from, the name of the collector, the date and method by which the tissue sample was taken, etc.) and its exact location within a freezer.

Detailed guidelines for how to conduct an inventory of a molecular collection can be found on the [CryoArks website resources page](#) by downloading the [How to Conduct an Inventory of your Sample Collection](#) document and its associated data collection sheets. These resources will take you through the process step-by-step, but to complete a comprehensive inventory you may need to recruit staff or volunteers to assist.

a The scope of this document

In this document we outline a range of training activities that cover the key skills used by those conducting an inventory of a molecular collection. The activities are short, use minimal resources and are designed with the intention that they can be run in house by the person responsible for the collection for the benefit of the staff and/or volunteers that will be handling the data/samples. Each activity focuses on a different aspect of collections management, therefore you can select and run the training activities most appropriate to your circumstances.

Running hands on training in sample and data handling with your staff/volunteers will:

- Help to familiarise your team with the collections and locations they will be working with.
- Help ensure that the samples are handled appropriately by all members of the team.
- Help ensure that the data are collected and recorded consistently by all members of the team.
- Provide your team with information on the types of hurdles they may encounter and better equip them to troubleshoot.
- Help your team develop confidence in their ability to conduct the work and thus improve efficiency.

The activities listed below have been run with our own staff and volunteers across the CryoArks partner institutions. They are tried and tested and have proven effective in helping to develop the skills required to conduct an inventory efficiently. We hope you find them useful.

Training Activities - Sample Handling

This group of activities focusses on some of the practical elements of the tasks that your team may be required to undertake when following the workflow described in the 'How to Conduct an Inventory of your Sample Collection' document. Your team is encouraged to open the freezers, assess the format in which the samples are stored, handle tubes on ice and practice reading and transcribing data. It's time to get hands-on!



Figure 2.1: Volunteers taking part in a training day on conducting an inventory of molecular collections held in the Molecular Collection Facility at the Natural History Museum, London. Image by Veit Braun.

a Box Locations

In this activity your team will practice recording box locations within a racked freezer. The freezer arrangement format will enable them to easily find and consistently record the location of boxed samples in cold storage.

Preparation

- Access to a freezer that they will be working in or one with a similar arrangement.
- Printouts of the freezer arrangement guide for each person/group (see figure 2.2).
- Identifiable sample boxes placed at known locations within the freezer.
- Equipment for each team to record box locations.
- Appropriate personal protective equipment for accessing shelves and drawers within the freezer.

Activity

1. Refer to the print out of the freezer arrangement and describe how to find and record the location of a box in the freezer.
2. Allow the team to access the freezer themselves and present them with a series of box locations to find e.g. shelf 2, rack 3, drawer 1, box 2.
3. Instruct your team to find the sample boxes you have placed in the freezer and record the locations in the format described.
4. If appropriate open a different freezer or fridge to demonstrate how the arrangement can be applied in principle to any racked collection in cold storage.

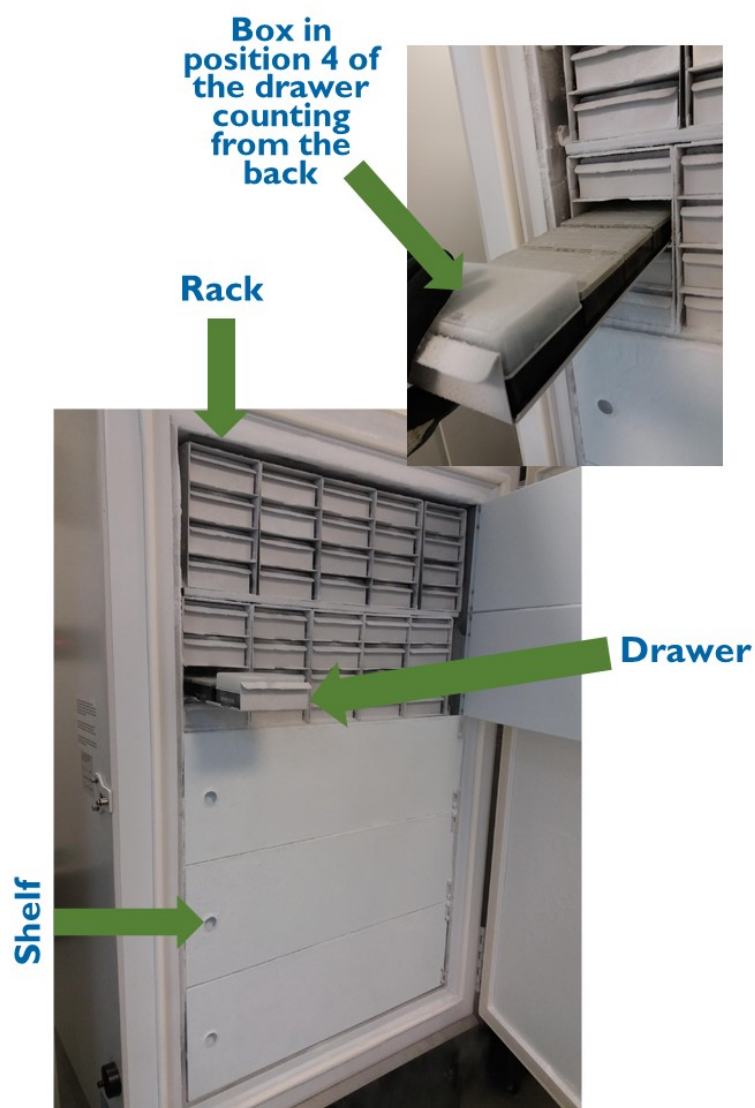


Figure 2.2: The arrangement of drawers, shelves and racks in a large upright freezer.

Points to Highlight

- Begin with the freezer name and record the shelf counting down from the top. The rack number counting from left to right. If the rack has multiple drawers, count down from the top. When pulling out a drawer and recording the position of the box within it, count from the rear forwards (see page 22 of the [How to Conduct an Inventory of your Sample Collection](#) document).

b Tube Locations

In this activity your team will practice recording tube locations within a box. The box layout will enable them to easily find and consistently record sample locations within a range of box sizes.

Preparation

- Printouts of the box arrangement image for each person/group (see figure 2.3).
- A selection of sample boxes, including 48 and 96 well rectangular boxes and 81 and 100 well square boxes as appropriate to your collection. Boxes with and without labels will also be useful.
- Boxes containing tubes in known locations for your team to record.
- Equipment for each team to record box locations.

Activity

1. Refer to the print out of the box arrangement and describe how to find and record the location of a tube in a box.
2. Hand the team a range of boxes to look at and ask them to discuss the pros and cons of each in relation to handling samples stored in them and interpreting data on them.
3. Hand the team the boxes containing tubes and ask them to record the location of each tube in each box.
4. Discuss ways to help them record tube locations accurately.

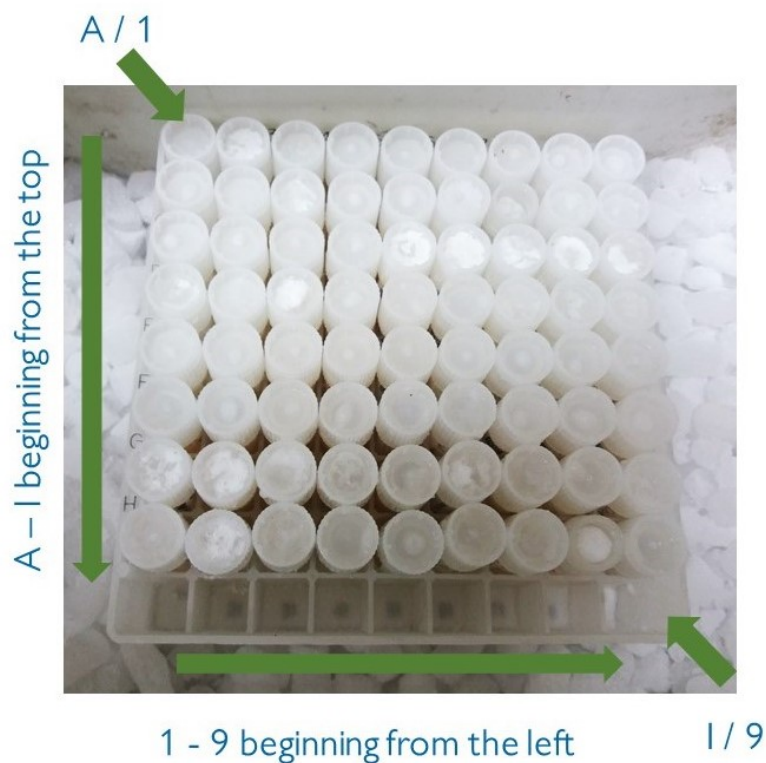


Figure 2.3: A tube box with the column and row numbering system displayed.

Points to Highlight:

- If the wells are marked, note the row character then column character separated by "/". If the wells are not marked and it has a hinged lid, orientate the box so that it opens away from you with the latch at the front and hinge at the back. The first well is the back left and is recorded as row A / column 1. The row letters will be sequential counting from the back forwards and the columns will increase by number counting from left to right. If the box has no well markings and a lid with no hinge, write on the box to indicate the front and back (see page 22 of the [How to Conduct an Inventory of your Sample Collection](#) document).
- Taking a photograph of the box showing the format, orientation and tube arrangement or writing the tube locations into a printed diagram of the box arrangement can be helpful to use as a reference. Both images could be embedded into the spreadsheet (see page 21 of the [How to Conduct an Inventory of your Sample Collection](#) document).

c Handling Samples

In this activity your team will practise the appropriate way of handling samples on ice/dry ice when relabelling, reformatting or transcribing sample data. Allow time for the team to do the activity repeatedly so they can get comfortable handling the boxes and tubes whilst wearing the necessary personal protective equipment.

Preparation

- Cool bucket/polystyrene box, ice/dry ice, sample storage box, sample tubes and forceps.
- Appropriate personal protective equipment for handling samples at cold temperatures.

Activity

1. Demonstrate where the ice/dry ice is stored, how to access it and how to decant it into the cool bucket/polystyrene box safely.
2. Demonstrate ways to hold the tube both with and without forceps which enable you to see all the information on it i.e. any codes on the cap or labels down the sides.
3. Encourage each participant to open a box, remove a tube, read the information on the tube, place the tube back in the correct well of the box and close the lid of the box.
4. Demonstrate how to isolate a tube (e.g. in a labelled zip locked bag) if it is damaged or leaking and run through the procedure for reformatting to a new tube should this be necessary.
5. Discuss the health and safety considerations when handling ice/dry ice in their work space and what to do with the remainder once the work is complete.



Figure 2.4: Volunteers taking part in sample handling training in the Molecular Collection Facility at the Natural History Museum London. Image by Veit Braun.

Points to Highlight

- Share ways to hold the box and tubes to avoid spillage or damage e.g. handle the tube with forceps below the cap (see this demonstrated in figure 2.4) as it may be loose/damaged or come off, keep the tube upright as the buffer inside may pose a risk to the labelling on the surface of the tube should a leakage occur and keep the box/tubes over the cool bucket/polystyrene box at all times as if dropped it is less likely to be damaged or lost.

d Handwriting

This activity focuses on the challenges of transcribing written labels.

Preparation

- A selection of empty tubes without labelling (unless barcoded) preferably a range of sizes (e.g. 0.5ml and 2ml) representing the range they will encounter when conducting the inventory of the collection.
- Markers to write on the tubes, preferably a range of colours and thicknesses.

Activity

1. Hand each member of your team a tube of each size and ask them to select a marker at random from your selection.
2. Ask your team to write a sequence of numbers and a sequence of letters on the tube called out by the training leader (as demonstrated in figure 2.5), include likely problem characters they may encounter e.g. 0,7,4,A,O,D,I. Don't give any further instructions i.e. orientation or upper/lower case etc.
3. Once the labels have been written ask them to swap each tube with a different member of the group. Then they are to describe what they notice about how the label and the characters have been written.
4. Discuss the different ways that a group of people have written the same characters and what to look out for when reading hand written labels on tubes, boxes and other sample containers.



Figure 2.5: Volunteers taking part in the handwriting activity in the Molecular Collection Facility at the Natural History Museum, London. Image by Veit Braun.

Points to Highlight

- Highlight that everyone will write differently and they may encounter a range of characters that are written ambiguously when conducting an inventory. Getting a second opinion and/or consulting the original collector (if possible) is important when interpreting handwriting on boxes and tubes.

e Transcribing

This activity enables your team to practise working in pairs transcribing data from tubes to the data collection sheet.

Preparation

- The [Thorough Inventory Data Collection Sheet Template](#), or any alternative data collection sheet you intend your team to enter the data into, open on an accessible computer.
- Cool bucket/polystyrene box, ice/dry ice, sample storage box and forceps.
- Appropriate personal protective equipment for handling samples at cold temperatures.
- Empty tubes without labelling (unless barcoded), enough for one per person participating in the activity. Preferably of the size the team will encounter most when conducting the inventory of the collection.
- Markers to write on the tubes, preferably a range of colours and thicknesses.

Activity

1. Hand out a tube to each participant and ask them to select a marker at random from your selection.
2. Ask them to write a species name, date, location, tissue type and buffer on the tube in any format or orientation. Preferably do not specify what species etc. they should enter as ideally there will be a range of data to subsequently record.
3. Collect the tubes and place them in a sample box in a random arrangement. Place the box on ice/dry ice in the cool bucket/polystyrene box.
4. Split the group into pairs and ask one member of each pair to wear the appropriate personal protective equipment for handling the samples. The other participant will be the scribe and will enter the information called out by the sample handler.
5. Each pair should enter the data for each tube into the data collection sheet (see figure 2.6) swapping half way so each participant can practise both roles.



Figure 2.6: Volunteers taking part in the transcribing activity in the Molecular Collection Facility at the Natural History Museum, London. Image by Veit Braun.

Points to Highlight

- Emphasise here the importance of communication between the scribe and the sample handler. The data should be transcribed as it is stated on the sample and box and if anything is unclear it should be described in the notes field.

f Cold Chain

In this activity the various options for transporting samples are discussed alongside a demonstration of the equipment if available. Running this activity would be beneficial if your team will be receiving new collections, or if the collection they are working on has cold chain data associated with it.

Transportation at -20°C

- The equipment used by your organisation to transport samples at -20°C may include polystyrene boxes containing cold blocks/ice or portable freezers (as shown in figure 2.7).
- Demonstrate how you would expect samples to be sealed in a bag, box or other container with absorbent material as necessary.
- Discuss the labelling that should be associated with the samples to identify the hazards within and their health and safety considerations.
- Run through the procedure for opening packages, sorting the samples and placing them in long-term storage wearing the appropriate personal protective equipment.



Figure 2.7: A portable freezer capable of transporting samples at temperatures as low as -80°C. Image by Fiona Allan.

Transportation at -80°C

- The equipment used by your organisation to transport samples at -80°C may include boxes for the safe transportation of dry ice (as shown in figure 2.8) or portable freezers.
- Demonstrate how you would expect sample tubes to be sealed in a bag, box or other container (with absorbent material as necessary) before being placed in the appropriate packaging.
- Demonstrate the appropriate boxes for transporting dry ice e.g. polystyrene box with cardboard sleeve, the appropriate hazard labelling and the health and safety considerations of handling dry ice.
- Discuss other labelling that should be associated with packages of samples identifying the hazards within and their associated health and safety considerations.
- Run through the procedure for opening packages, sorting the samples and placing them in long term storage wearing the appropriate personal protective equipment.



Figure 2.8: The appropriate box for transporting samples on dry ice demonstrated during the volunteer training day in the Molecular Collection Facility at the Natural History Museum, London. Image by Veit Braun.

Transportation at -150°C or colder

- The equipment used by your organisation to transport samples at -150°C may include dry shippers (as shown in figure 2.9).
- Demonstrate the internal cylinder and external features of the dry shipper, allow your team to handle the equipment if not charged.
- Describe how it is charged and the health and safety concerns when transporting and handling dry shippers, including manual handling.
- Discuss the health and safety considerations of decanting samples into and out of the shipper.
- Discuss the labelling that should be associated with packages of samples identifying the hazards within and their associated health and safety considerations.
- Run through the procedure for decanting, sorting and storage samples wearing the appropriate personal protective equipment.



Figure 2.9: A large dry shipper capable of transporting 5 boxes of tubes at ultra cold temperatures demonstrated during the volunteer training day in the Molecular Collection Facility at the Natural History Museum, London. Image by Veit Braun.

Training Activities - Data Handling

This group of activities focusses on the key considerations of consistently and accurately recording data associated with a molecular collection. The workflow described in the 'How to Conduct an Inventory of your Sample Collection' document refers to the initial and thorough data templates developed by the CryoArks team specifically for the inventory process. These resources are available on the [Resources page](#) of the CryoArks website. Your team is encouraged to record as much data as possible using the templates as a guide.



Figure 3.1: Volunteers taking part in the data handling session during the training day on conducting an inventory of molecular collections held in the Molecular Collection Facility at the Natural History Museum, London. Image by Veit Braun.

a Barcoding

In this activity the various ways of utilising barcodes to manage samples and their associated metadata are discussed alongside a demonstration of the equipment if available.

Barcode Labels

- The equipment used by your organisation to label samples with barcodes may include cryo-resistant adhesive labels or tubes and or boxes etched with single or two-dimensional barcodes (see an example in figure 3.2).
- Demonstrate the range of barcodes used by your organisation and discuss the reasons why barcodes may be beneficial for sample handling and data management.

Barcode Scanning

- The equipment used by your organisation to record barcode labels may include a hand-held and/or rack scanner (see an example in figure 3.2).
- Run through the procedure for using the equipment including any health and safety considerations.



Figure 3.2: Barcoded tube being scanned. Image by Veit Braun.

b Collection Data Induction

This activity focuses on introducing your team to the existing data associated with the collection they will be working on.

Preparation

- Conduct an initial inventory of your molecular collection following the instructions in chapter 2 (page 4-11) of the [How to Conduct an Inventory of your Sample Collection](#) document. Record the curation unit data using the CryoArks Initial Inventory Data Collection Template.
- Ensure that the completed initial inventory datasheet is visible to the team.

Activity

1. Provide an overview of the process used to complete the initial inventory of the sample collection. It can be helpful to refer to the initial inventory workflow on page 5 of the [How to Conduct an Inventory of your Sample Collection](#) document.
2. Describe each curation unit as detailed in the initial inventory (see an example in figure 3.3). Pay particular attention to practical details that the team will need to be aware of, e.g. the physical location of the freezers which house the collection, the location of the metadata and any collection care requirements that will need to be addressed as the thorough inventory is conducted.
3. Demonstrate where to access the initial inventory for future reference.

	B	C	D	E	F	G	H	I	J	K	L
	Curation Unit	Number of samples	Contents	Metadata	Data Location	Data Description	Location Known?	Ownership	Location Confirmed	Containers	Care Needs
1	Amphibians	< 100	Tissue samples, specimens from South America including some super rare frogs!!	Yes - Collections Management System (Adlib)	Adlib collection database Record number 000001 - 000092	Individual record per sample in collection, 92 records in total all have taxonomy, collector, location and cold chain information	Yes - Exact location (Collections facility, Freezer 3, bottom 2 drawers)	My Institution	Collections facility, Freezer 3, drawers 7 and 8	Cryovials in 25 latched and barcoded boxes	None
2	Reptiles	100 - 1000	Mostly DNA extracts of lizards from Africa and Snakes from Australia collected during research project trips	Yes - Spreadsheets	C:\Documents\ Collections Inventory\Reptiles	Two spreadsheets: One for lizards and one for snakes Both include taxonomy, collection location and collector	Yes - Rough location (Freezer 5 in Basement)	Joe Bloggs, Hypothetical University, UK	Found in Basement, Freezer 5, drawers 1, 2, 3 and 4	Eppendorf tubes in 81 well boxes. Approx 60 boxes	Relabelling: Barcode boxes and tubes
3	Fish	100 - 1000	Tissue and DNA extracts of deep sea fish from the South Atlantic	No - None that I know of	C:\Documents\ Collections Inventory\Fish	Single spreadsheet with a list of taxa collected	No - I'm not even sure they are still here (Possibly on loan to Hypothetical)	My Institution	Found in Basement, Chest Freezer 2,	5 to 50ml tubes in bags.	Reformatting: New cryovials and barcoded racks.

Figure 3.3: Curation unit details captured in the CryoArks Initial Inventory Data Collection Template available [here](#).

c Using The Data Template

In this activity your team will become accustomed to using the 'CryoArks Thorough Inventory Data Collection Template' to record sample data.

Resources

- Ensure your team has access to the '[Thorough Inventory Data Template](#)' either in pairs or as a group.
- Provide each member of the team with a copy of the 'How to Conduct a Thorough Inventory' workflow on page 14 and the 'Conducting a Thorough Inventory Step-by-Step' instructions on pages 28-30 of the [How to Conduct an Inventory of your Sample Collection](#) document.
- Ensure you have read and understood the 'Conduct a Thorough Inventory' chapter (chapter 3, pages 13-27) of the [How to Conduct an Inventory of your Sample Collection](#) document.

Activity

1. Introduce the team to the 'Thorough Inventory Data Template'. Highlight the curation unit details that are available at the beginning of each curation unit data collection sheet and the area in which they are to enter the data (shown in figure 3.4).
2. Using the data entered during the transcribing exercise (or other available example data) run through the data which is to be entered and the format in which it should be recorded referring to the field descriptions tab (shown in figure 3.5).
3. Discuss and have the team update the field descriptions tab with naming conventions and/or shorthand that they are to use when recording the sample data.
4. Referring to the practical activities previously completed and the thorough inventory step-by-step instruction given, have the team enter details of the workflow they will follow, the resources they will need (and where to find them), the way in which they will handle samples and enter data and the location in which the data will be stored, as well as any health and safety considerations in the process notes tab.

Fields to be completed per sample:																
Freezer Arrangement					Box Details					Tube Details						
Freezer Name	Shelf	Rack	Drawer	Box Position	Box label (top)	Box label (side)	Box Barcode	Box photo outside	Box photo inside	Well position	Tube label (top)	Tube label (side)	Tube barcode	Tube type	Sample type	Preservative

Figure 3.4: Freezer, box and tube details captured in the CryoArks Thorough Inventory Data Collection Template available [here](#).

Points to Highlight

- Editing the field descriptions tab of the 'Thorough Inventory Data Template' (see figure 3.5) and including field descriptions for any metadata unique to each collection unit will ensure your team fully understand the data to be recorded and that they do so consistently.
- Completing the Process Notes tab will enable your team to bring together all that they have learnt from the practical activities as well as all of the information they have been given from the site and collection inductions, culminating in a detailed account of the inventory process to be conducted. This will enable you to assess that they have understood the instructions given to them and provide a reference for them to refer back to that is entirely unique to you collection and space.
- The process notes also provide instruction to any new team member continuing work on the inventory or other team members that have not worked on that particular curation unit previously. Thus, helping to ensure that the data are recorded accurately and consistently regardless of whether it is completed by multiple individuals over time.

Category	Field headings	Description	Abbreviations (if used)
Auditors	Counter	Count to keep track of the number of samples	
	Inventory date	Date of the sample audit YYYY_MM_DD	
	Sample handler	Name of sample handler	
	Scribe	Name of scribe	
Freezer Arrangement	Freezer Name	Freezer name/identifier	
	Freezer Shelf	Shelf number counting from top to bottom	
	Freezer Rack	Rack number counting from left to right	
	Freezer Drawer	Drawer number counting from top to bottom	
	Freezer Box Position	Box position counting from the back	
Box Details	Box label (top)	Transcription of the labelling on the top of the box	
	Box label (side)	Transcription of the labelling on the side of the box (Indicate which)	
	Box barcode	Box barcode	
	Box photo outside	Take a photograph of the outside of the box, any labels must be clearly in focus	
	Box photo inside	Take a photograph of the inside of the box, tube arrangement must be clearly in focus	

Figure 3.5: The field descriptions tab of the CryoArks Thorough Inventory Data Collection Template available [here](#).

How CryoArks can help

If you are reading this document, you may have already visited the [CryoArks website](#), where in addition to a wealth of information and resources available, you will see that we offer advice, guidance and training. Below are some of the frequently asked questions associated with conducting an inventory of a molecular collection:

- **Can someone from the CryoArks project help me to train my team?**

Yes, it is possible for a member of the CryoArks team to visit your collection and offer advice as well as training activities to your team, such as those detailed in this document. Or it may be possible for your team to attend training at one of the CryoArks hubs if appropriate.

- **Can the CryoArks project inventory my collection?**

As much as we may like to, we do not have the capacity to conduct the inventory of your collection on your behalf. However, we can provide information and guidance that will assist you and your team to conduct the inventory in house.

- **Could I host a volunteer programme jointly with CryoArks?**

Yes, this has been done successfully between CryoArks partner organisations where the recruitment, training and management of the volunteers was shared. However, participation in a joint volunteer program will be dependent on the capacity of the CryoArks partner organisation and would be handled on a case-by-case basis.

In addition to assisting you in conducting an inventory of your collection, the CryoArks project can help by making your samples discoverable to the research community and by safeguarding the samples for the future. For more information please visit the [CryoArks website](#).

a How to get in touch



CryoArks Main Office

OnE - Organisms and Environment Division
School of Biosciences
The Sir Martin Evans Building
Cardiff University
Museum Avenue
Cardiff
CF10 3AX
Wales, UK



www.cryoarks.org



[@cryoarks](https://twitter.com/cryoarks)



enquiries@cryoarks.org

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