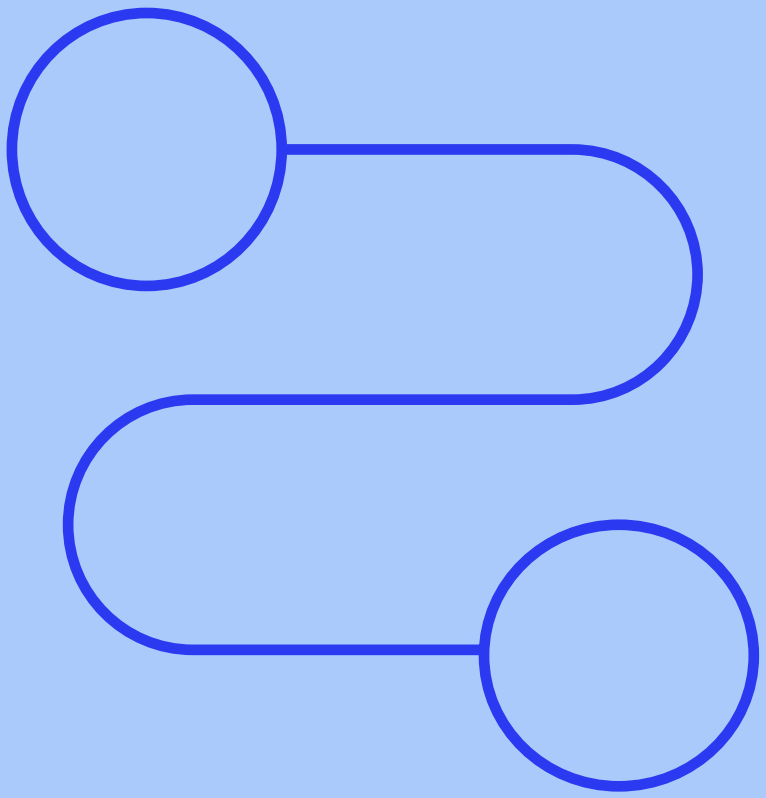
Workflows Development Guide

Solution Guide



Benchling

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Introduction

The Benchling Workflows process management application enables you to organize, optimize, and measure all your research and development workflows. It is a sequence of research processes and steps that are performed to answer research questions. You can develop and templatize workflows to connect the processes in your research pipeline.

With the Workflows application, you can drive efficiency across R&D processes by:

Increasing productivity across teams

Resolving bottlenecks to improve efficiency

Increasing visibility for process intelligence

Workflows terminology

Workflows

Workflows is a process management tool that integrates with lab automation and internal systems.

You can standardize your Organization's request fulfillment processes, manages assays or task requests, and connect processes in your research pipeline

Task Schema

A **Task Schema** is a template where admins can configure the identity and behavior involved in a workflow.

Flowchart

A **Flowchart** is a type of Task Schema that linearly groups other pre-existing Task Schemas together and allows the user to automatically map data between them

Execution Template

An **Execution Template** is an entry template to be used in the fulfillment of a workflows. The Execution Template is defined per Workflow Schema and is only applicable to entry execution types.

Task Group

A **Task Group** represents a set of jobs-to-do of the same type that were created together.

Task

A **Task** represents the jobs-to-do in a workflow. Each task has standard operational properties - as well as the custom fields that represent the parameters required to do the job.

Outputs

The **Outputs** of the workflow represent the result of completing a task. Each output links to one task from the workflow.

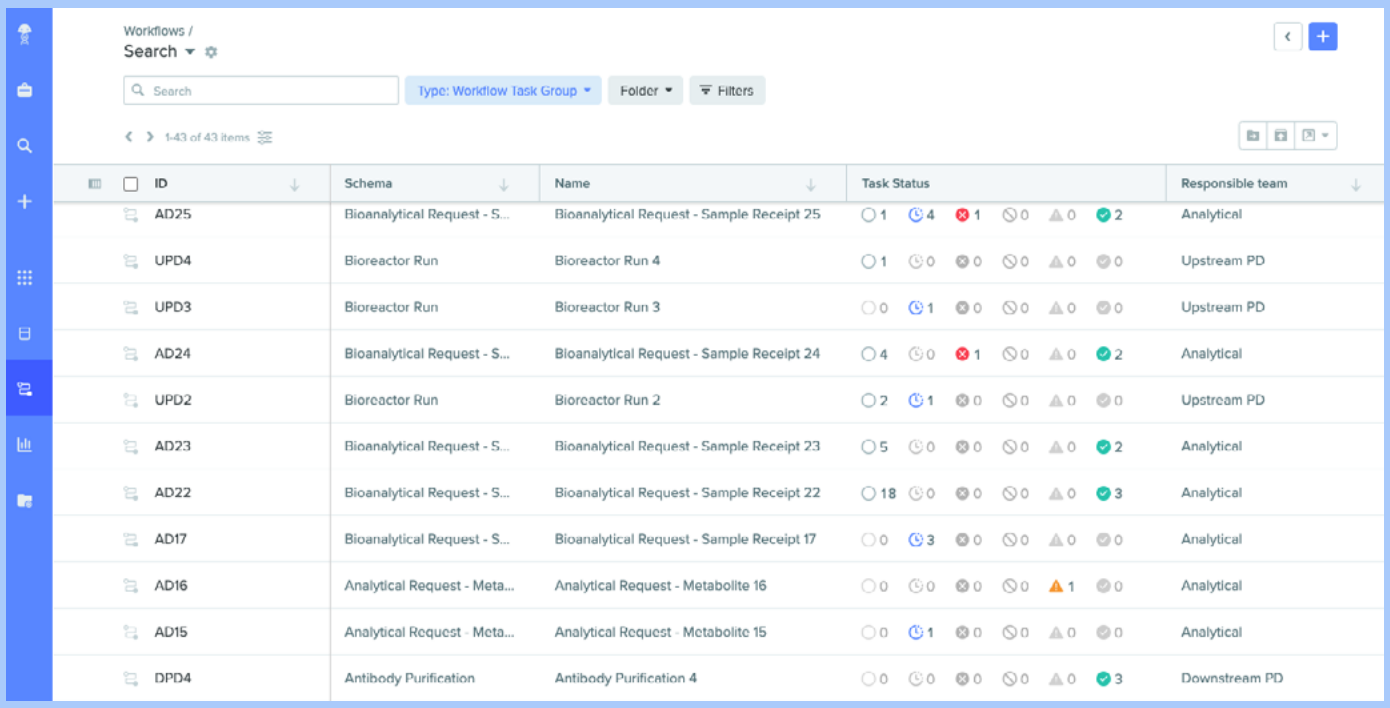
Flowchart

A **Flowchart** is a type of Task Schema that linearly groups other pre-existing Task Schemas together and allows the user to automatically map data between them. **Routers** enable to define custom logic and control mappings for inputs and outputs between Tasks.

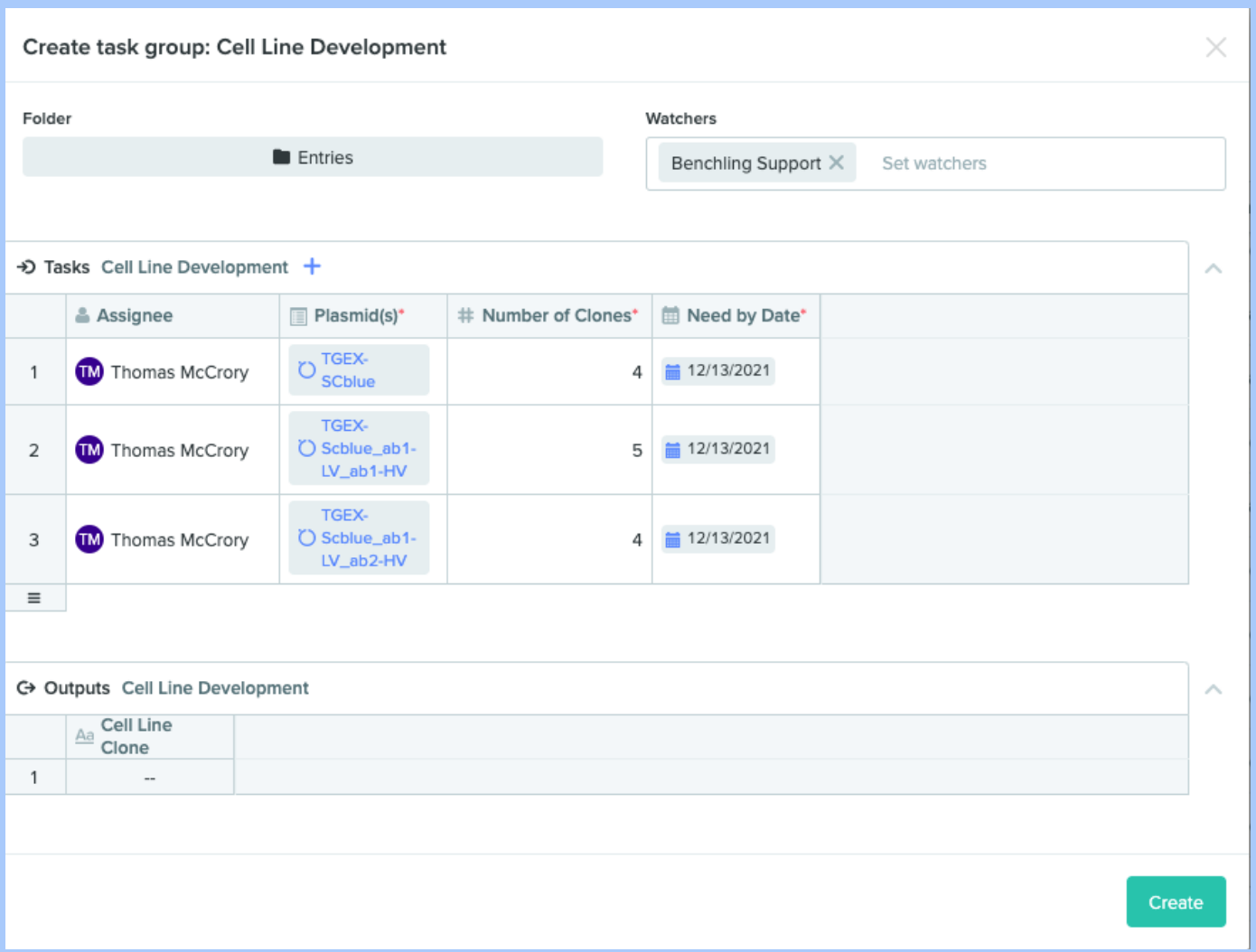
Snapshot: How are workflows represented in Benchling?

Workflows manager

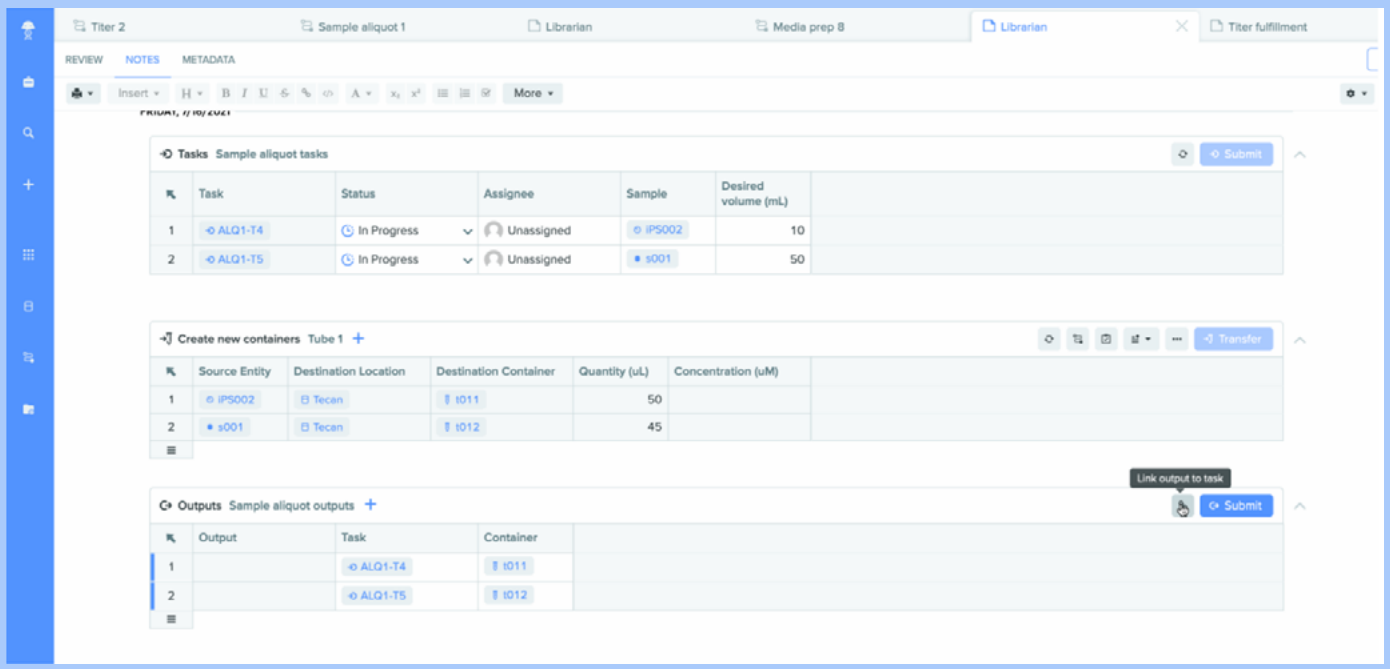
A view of the Workflows manager, where tasks can be searched using a variety of filters - tasks assigned to you, tasks of a certain status or type, etc.



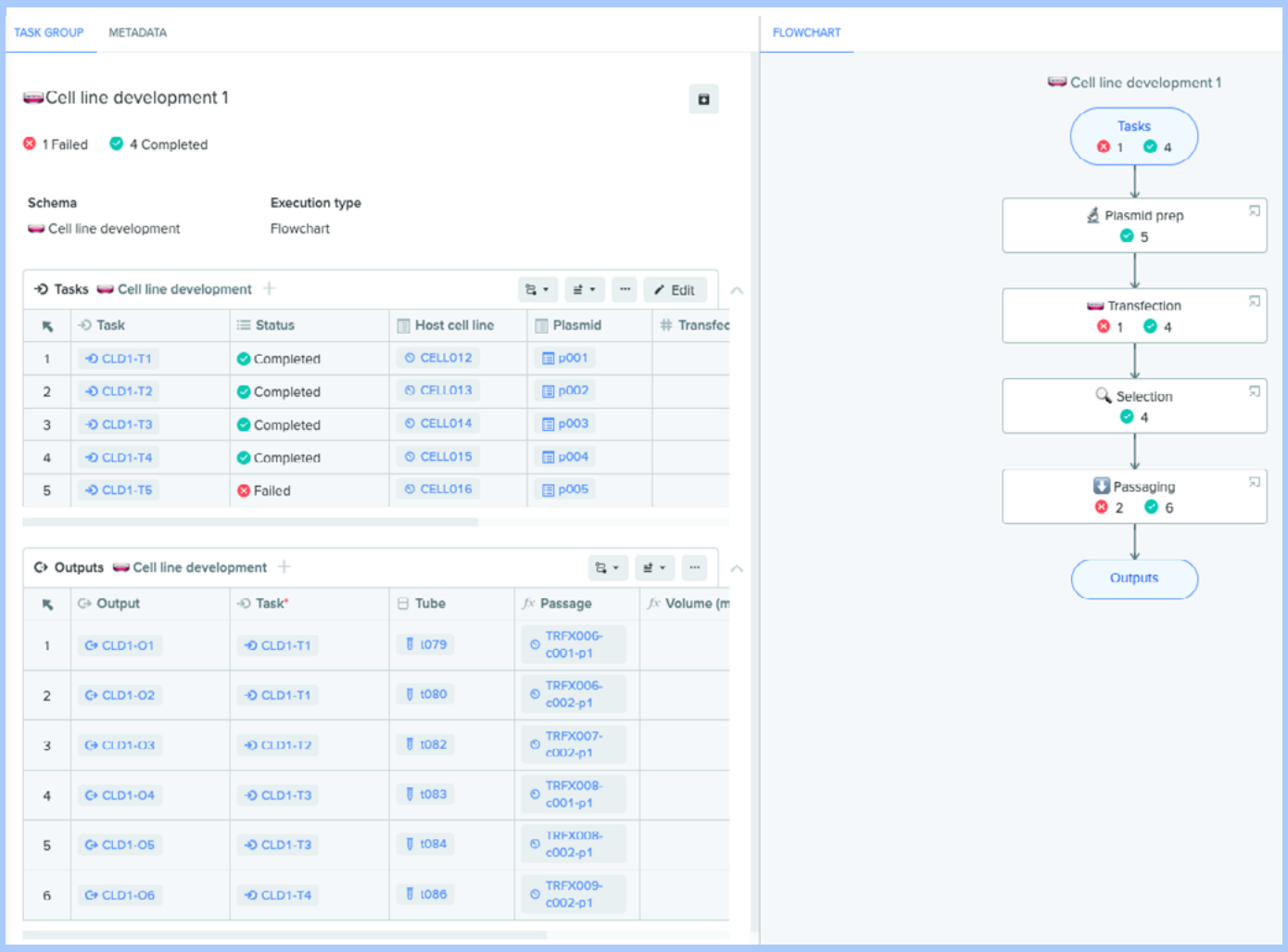
A view of a Cell Production task being created. In this view, you can find the configured fields and information that was filled out by the task creator.



A view of a task execution template. Note the Task Name, Status, Sample, and Desired volume are pulled in from the task.



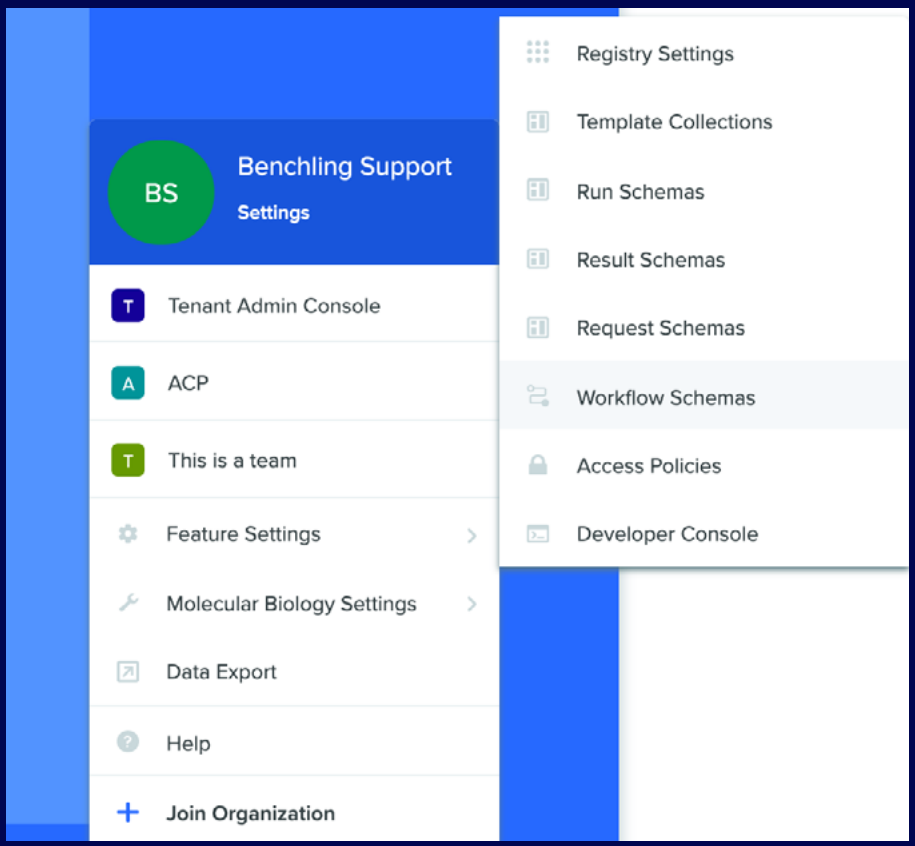
A flowchart task group with four completed tasks and one failed task



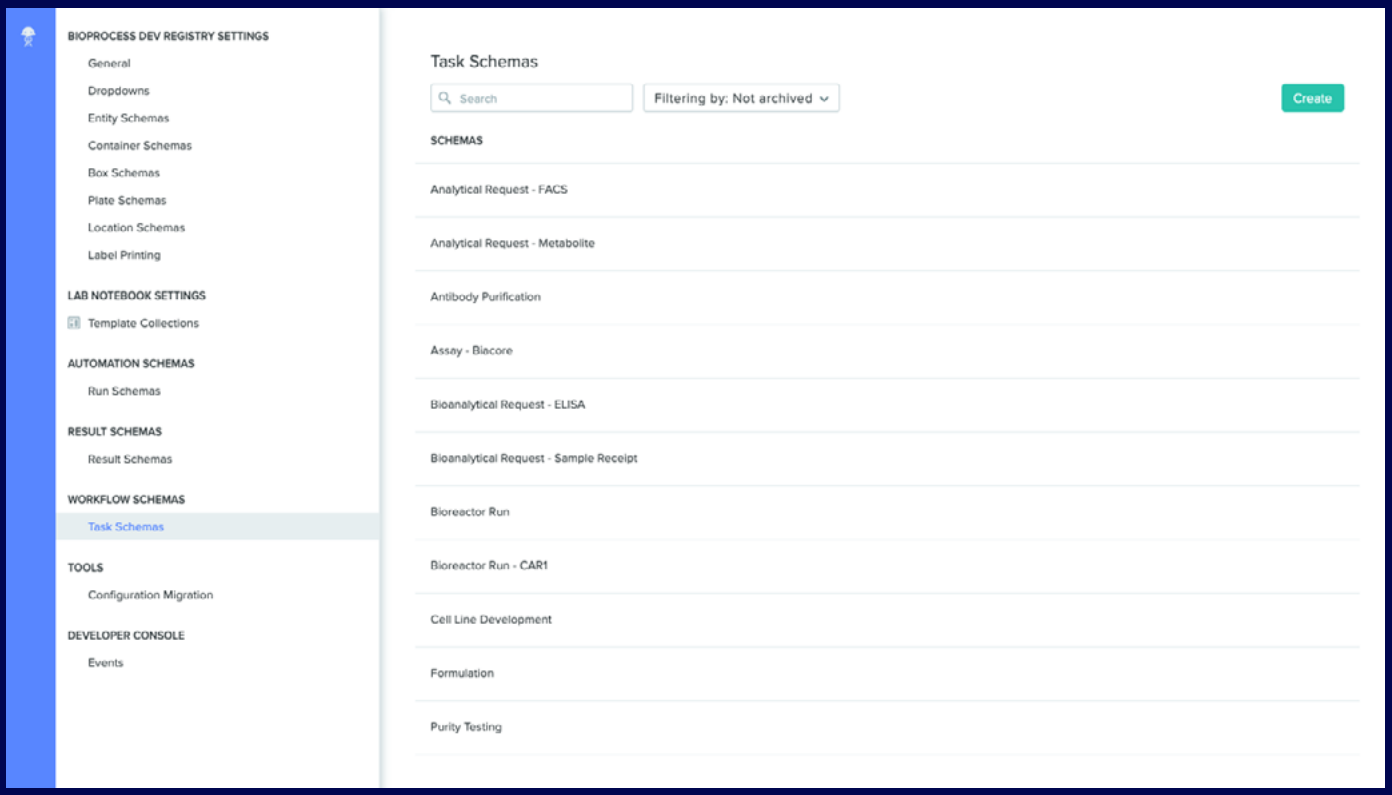
Introduction to configuring Workflows

Configuration of tasks and task groups is currently done using a point-and-click interface.

Configure task groups from the Task Schemas page in Feature Settings.



The Task Schemas page lists all current task schemas. You can create a new task schema by clicking Create in the top-right corner.



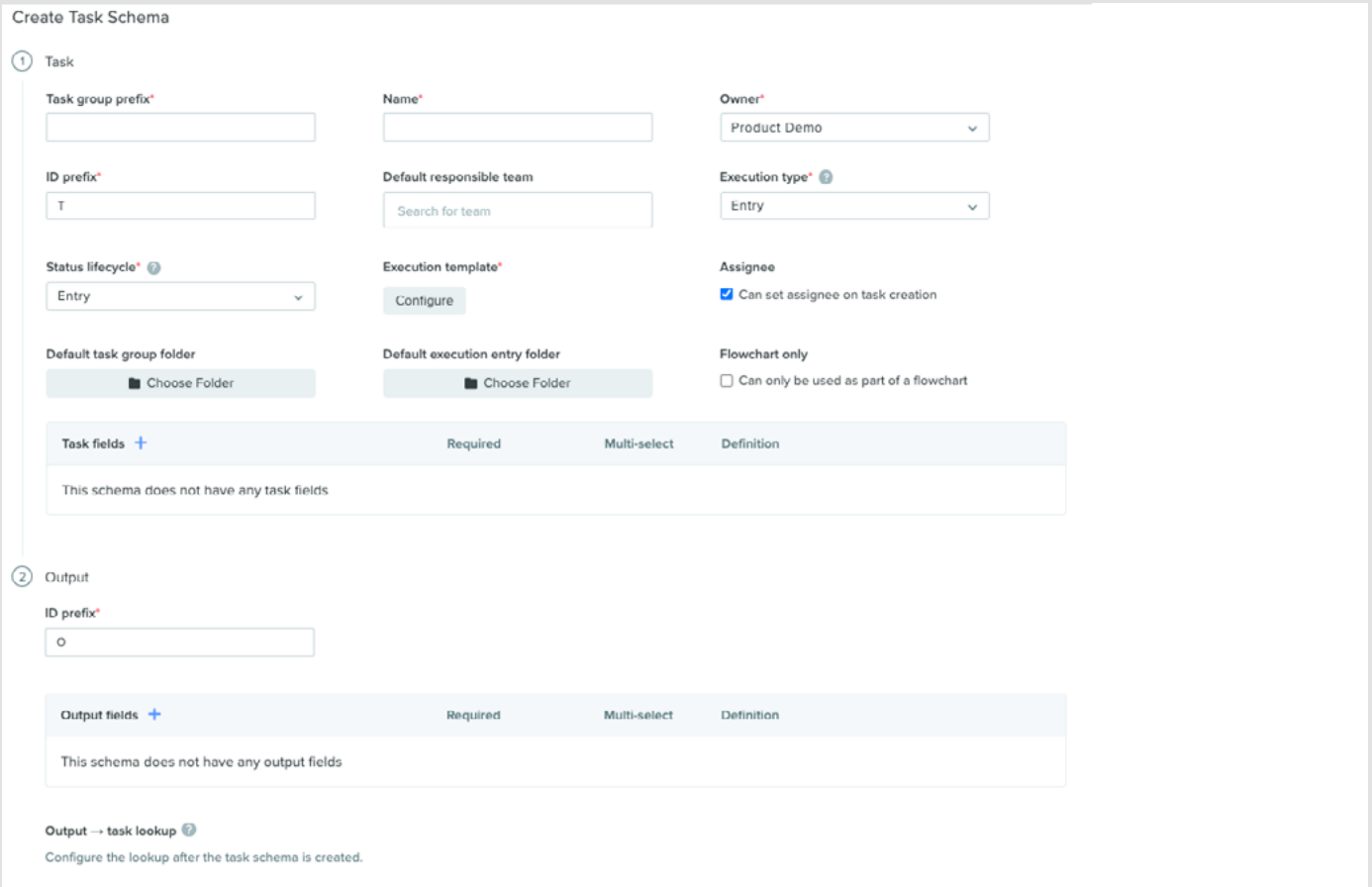
Task schema configuration

Task schemas define the type of assay or process step that will be tracked in the overall task group. Common task schemas include:

Scientist A wants to perform an assay on a registered cell line

Scientist B wants the protein scientist team to purify a protein from a cell supernatant

This is the Create Task Schema modal, where you create the tasks and associated outputs of task groups. We will go through each of these sections in more detail.



Task

Configure task properties and parameters that need to be completed. Required fields are indicated with a red asterisk. Task fields include:

Default responsible team (optional)
Automatically assigns a team responsible for this work. The assigned group receives notifications for new tasks.

Name
Descriptive name that displays in creation menus and search, and is used to generate names for task groups.

Task Group Prefix
Short prefix used to generate sequential, unique IDs for task groups.

Execution template
Configure the entry template used to execute tasks. This can only be selected if the task is assigned the Entry execution type.

Owner
Controls which organization owns the schema and has the permissions to edit.

Fieilds
Similar to Registry fields, there are multiple types of fields that can be configured on a task. These fields can be required or multi-select, depending on the field type

Execution type
Choose how your tasks are executed:

Entry: A scientist executes a task by creating a Notebook entry

Direct: A task marked as complete either directly or via the API

Flowchart: A scientist executes a series of ordered tasks, encompassing a complete process

Status lifecycle
Determine when tasks are defined as complete. Status lifecycles for tasks are:

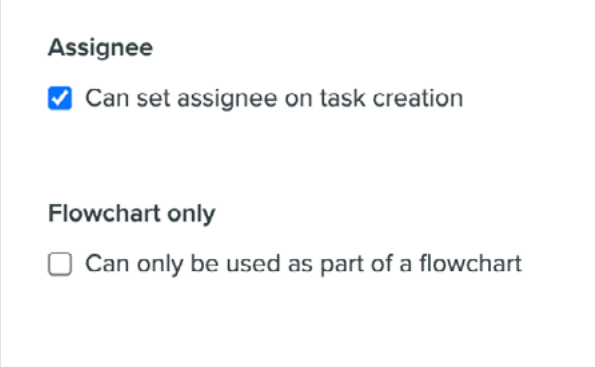
Entry

Entry review

Direct Completion

Flowchart

Snapshot Fields
A configurable task/output field that pulls Registry, Inventory, or Results information from a specified pre-existing field. The snapshot field captures information when the task is created or the output is submitted and does not update, even if the original source is updated.



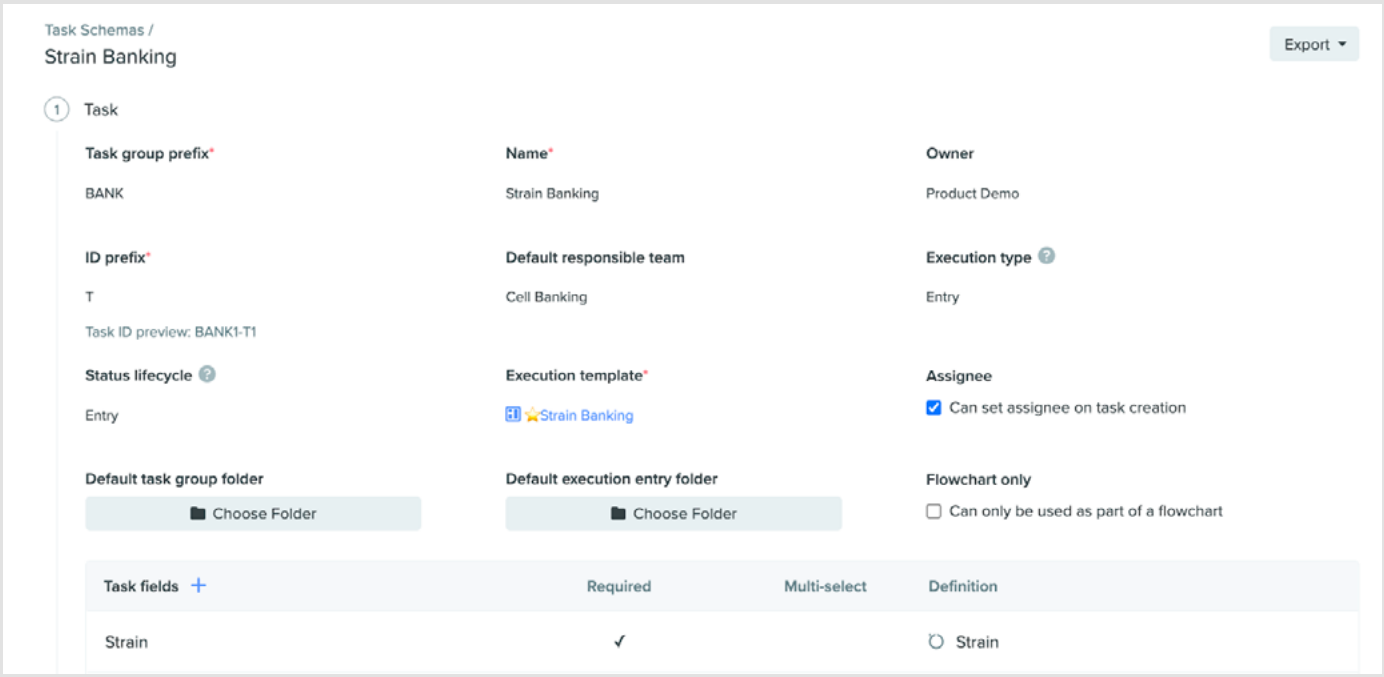
If a task schema uses the Entry or Direct execution type, you can choose to enable additional functionality as shown in the image above. These include:

Allowing for assigning tasks to users upon task creation

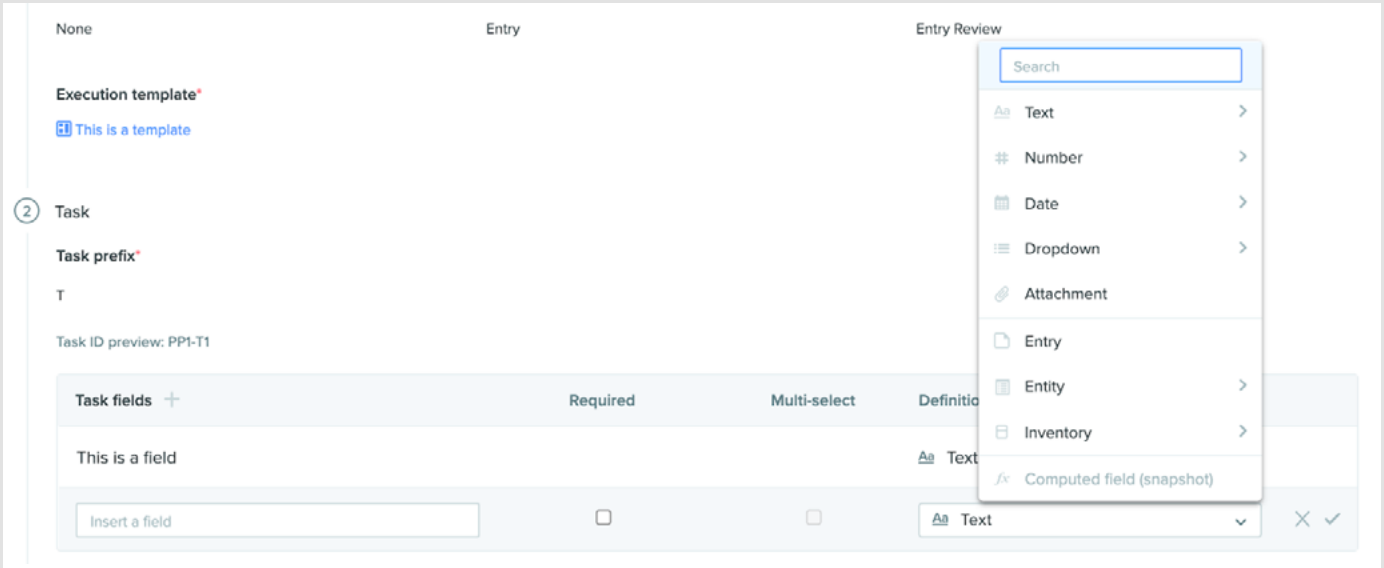
Restricting the task group used when assembling flowchart task schemas

Note: After a task schema is created, the Owner, Execution Type, and Status Lifecycle fields cannot be updated.

View of the Task section of the Task Schema module, where you configure the Tasks properties and fields.



View of all supported task fields with one task field already configured.



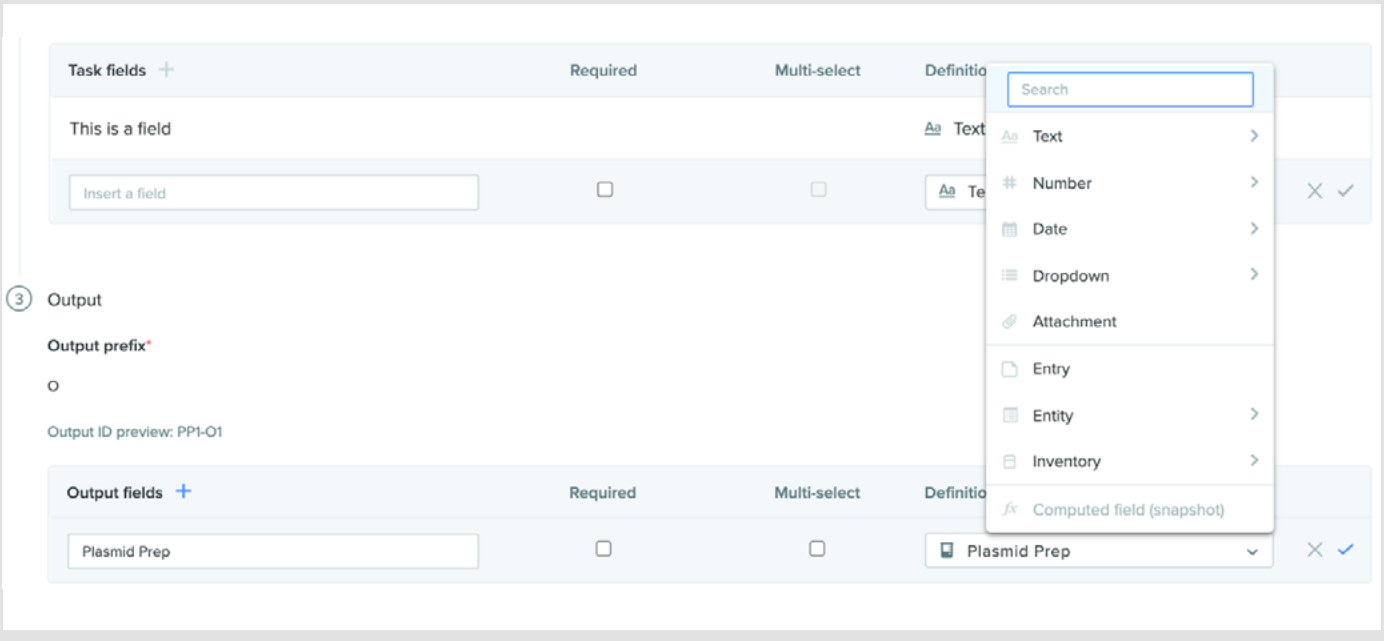
Output

Currently, every relationship between tasks and outputs needs to be configured with separate task group information. Required fields are indicated with a red asterisk. These fields include:

Tasks Prefix
Short prefix used to generate sequential, unique IDs for Outputs. The ID is structured as *workflowID-Prefix#*

Fields
Similar to Registry fields, there are multiple types of fields that can be configured on an output. These fields can be required or multi-select, depending on the field type. Common configurations are Registry entities or containers.
.

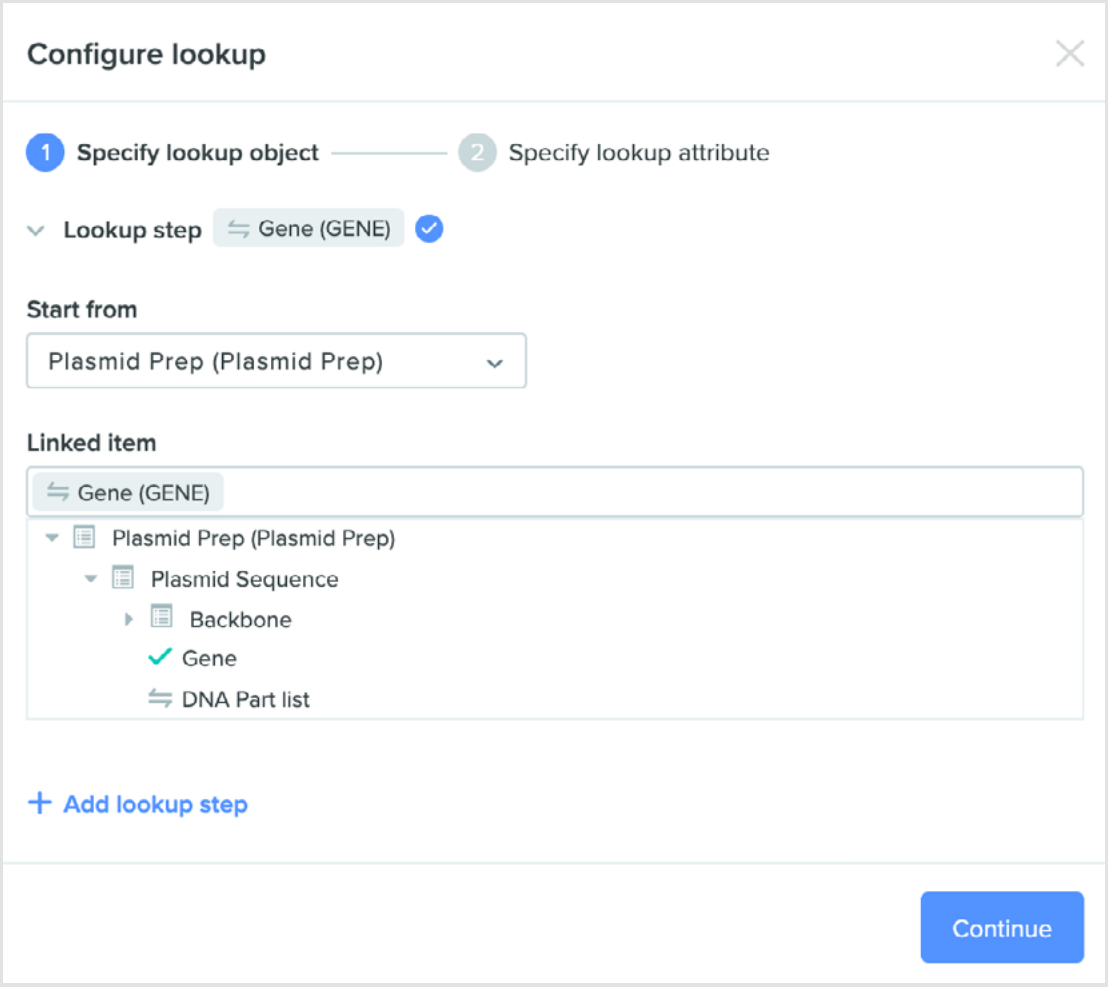
View of all supported output fields with one output already configured for a plasmid prep.



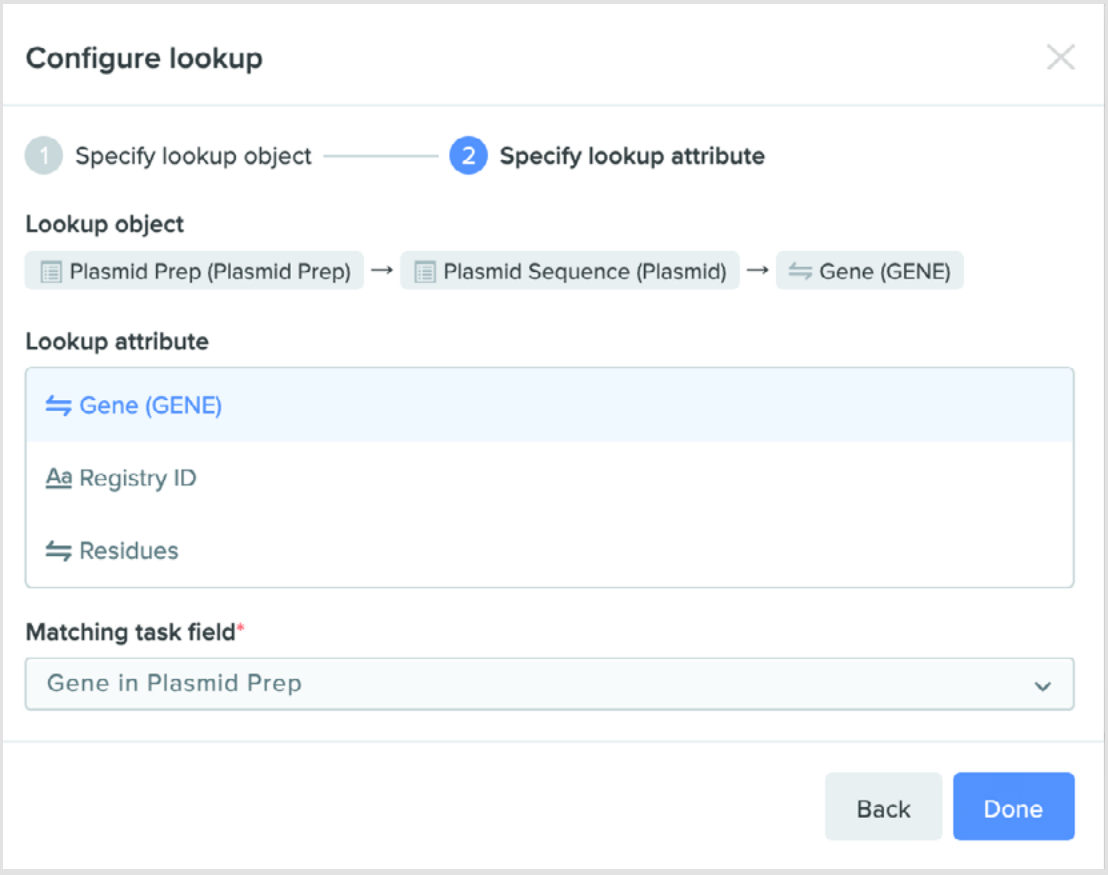
Output → Task Lookup

Based on Registry and Inventory lineage, you can automatically associate each output with a corresponding task field in the execution entry.

From the Plasmid Prep designated as the output of the task, we are looking up the gene expressed via a lookup configuration



The gene is associated with the Gene in Plasmid Prep task field



Execution template

When you select Entry as the task schema's execution type, you will need to configure a paired notebook entry template. This template will always be used to execute tasks for this workflow schema.

To create the initial template, click **Configure** on the task schema. Name your template and store it in an existing template collection. You cannot edit the contents of the entry template until the schema is created.

Edit templates by clicking the entry name on the task schema or via Template Collections. The name of the template will appear read-only until after the schema is created.

Add registration, transfer, and results tables and other useful content to the entry template to support your use case. You can add content above, below, or between tasks and output tables.

You cannot remove the tasks and outputs tables from the notebook entry template or configure default values or formulas.

Configuring a Flowchart

Flowcharts orchestrate workflows that span multiple steps and/or multiple users to improve collaboration and execution efficiency.

Flowchart schemas group task groups together to accurately map complex multi-step processes. Flowchart schemas may be configured to seamlessly map data through linear, branching, or merging pathways.

To configure a flowchart, you will:

1. Create the flowchart task schema.
2. Add steps to the flowchart.
3. Configure transitions between flowchart tasks.
4. Design a path for the flowchart to follow - or allow the user to define it themselves.

Create a flowchart task schema

To create a flowchart task schema:

1. Click your initials in the bottom-left corner to access your settings.
2. In the menu, hover over **Feature Settings** and select **Workflow Schemas.**
3. On the **Task Schemas** page, click **Create**.
4. Complete the Task section:
   - Fill in general task metadata such as title, prefix, and default responsible team.
   - Select **Flowchart** from the Execution Type dropdown menu.
   - Fill in the Task Fields table with the data required to begin the flowchart workflow. For example, an initial sample to process, a due date, or additional parameters related to your use case.
5. Complete the Output section by populating the Output Fields table with data to be produced by the flowchart workflow. For example, a final product, quality control metrics, or other output data.
6. Click **Create**.

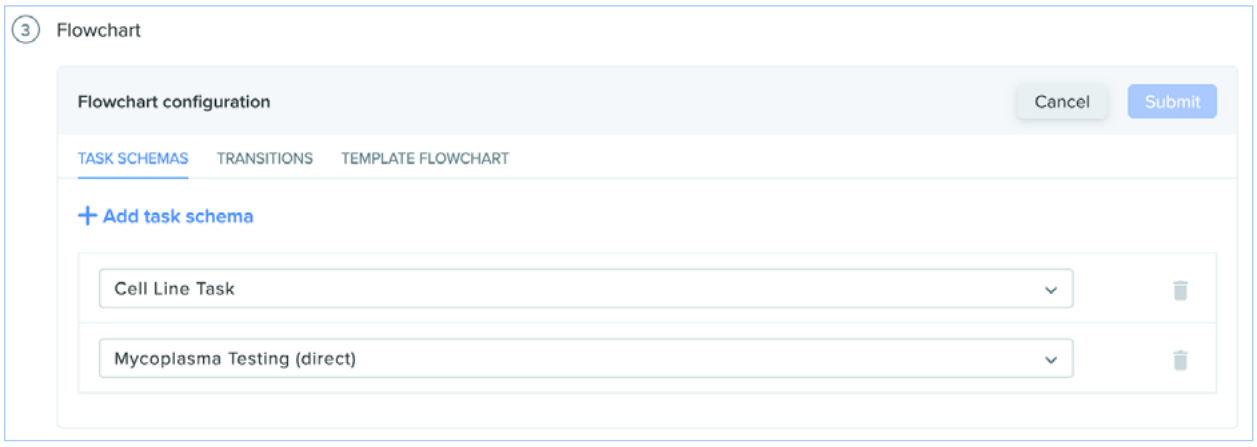
Add tasks to the flowchart

After creating the flowchart task schema, complete the flowchart section by first configuring the flowchart's steps. This section is unique to flowcharts and inserts other task schemas as steps between the flowchart's Task and Output.

To add steps to the flowchart:

1. Click **Edit** on the flowchart configuration table under the Flowchart section of the schema configuration page. Select the Task Schemas sub-tab.
2. Click **+Add Task Schema** to add new tasks to the flowchart.
3. Select the applicable task schema(s) from the drop-down menu.
4. Remove task schemas by clicking the trash can icon on the right-hand side.

Note: the order of the task schemas on this tab has no bearing on how the flowchart will be executed. You will define flowchart's path and data mapping properties in the next two steps.



Configure transitions between flowchart tasks

After configuring the flowchart steps, you need to configure how data is passed from one step to the next. Transitions allow users to move smoothly through flowcharts by connecting or mapping data between task schemas, and will automatically launch the next task when the previous one is completed. You may create transitions between any combination of task schemas selected for your flowchart in the prior step, as long as the data being mapped from the source properly aligns to the destination. Transitions determine the total number of viable paths your flowchart may take.

To add steps to the flowchart:

1. Click **+Add Transition** on the Transitions sub-tab of the flowchart configuration table.

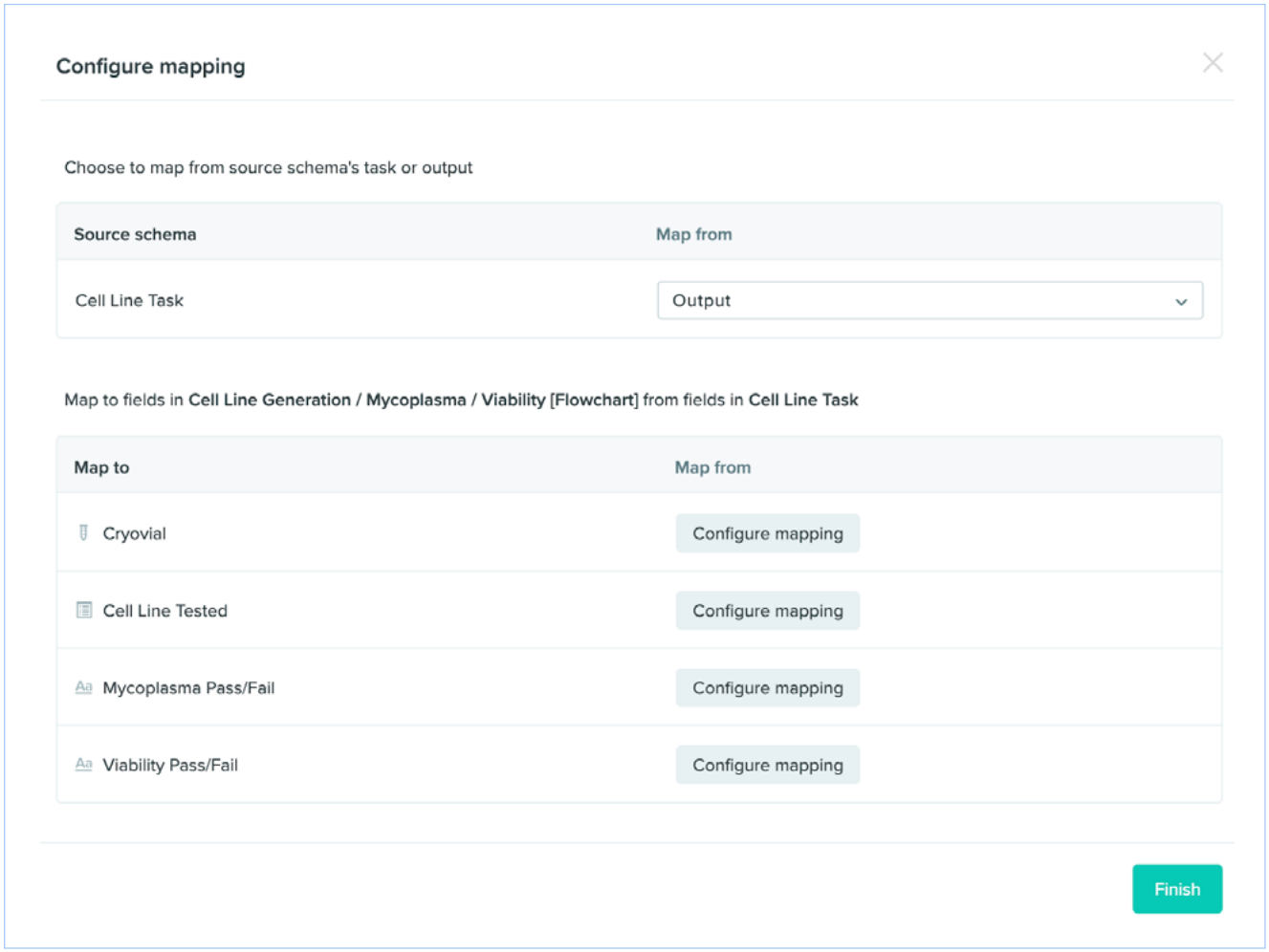
2. Select the source task schema(s) from the first drop-down menu.
   - Note: It is possible to map data from multiple source task schemas to the same destination task schema. You will be prompted to choose the source schema for each mapped field in the mapping window.Task table, by selecting **Flowchart task** as the lookup object.

3. Select the target task schema from the second drop-down menu.

4. Click **Configure** to configure the data mapping between your source and target task schemas.

5. Choose whether to map data from either the source schema's Output or Task table using the first dropdown menu. If you're mapping from multiple source schemas, make this decision for each source schema.

6. Click **Configure Mapping** next to each field on the destination task schema. You may configure mapping for any field on the destination task schema. You may choose not to map to certain fields, but at least one field must be mapped to save the flowchart configuration.



7 In the **Configure lookup** modal, select a lookup object and attribute to source the mapped data from.

- Generally, the lookup object is a field on the previous Task or Output table, and the attribute is the field value. You can also choose to map any value from the flowchart's Task table, by selecting **Flowchart task** as the lookup object.
- For more on Benchling's lookup functionality, visit Lookup columns and tables.

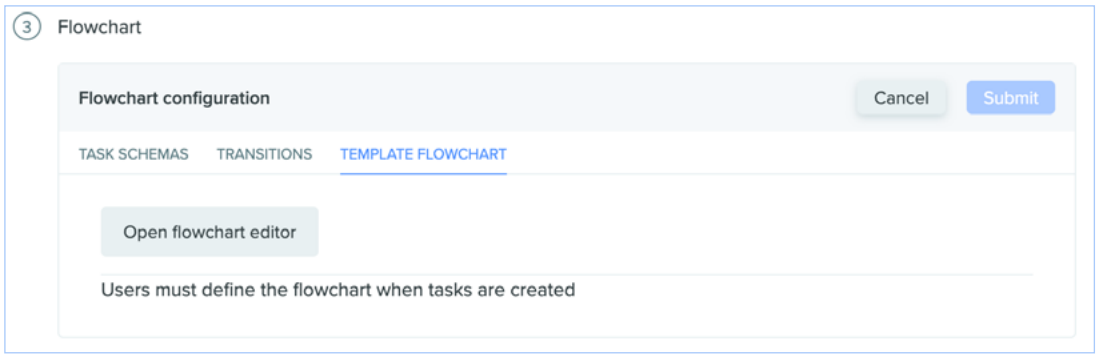
8 When all fields are configured, click **Finish**.

9 Repeat this process for each transition you'd like to create.

Configure a Template Flowchart

You can optionally build a template flowchart, which will serve as the default path your data will traverse any time you execute the Flowchart Task Group. You will choose from the task schemas you added earlier and draw transitions between these schemas based on what you have configured in the *transitions* tab. You may also add routers to the template flowchart, which allow you to direct tasks to downstream task groups based on configurable logic.

1 Click the **Open flowchart editor** button on the Template Flowchart sub-tab.



2 Click and drag **task schemas** from the right hand panel and arrange them in the order of your choice. Note that you can build branches and merges into your flowchart.

3 Click and drag **routers** (the diamond shaped box) from the right hand panel and position them between tasks in the flowchart. Refer to the "Configuring Flowchart Routers" section for more information on creating logic for the router to follow. *Note that the flowchart will have errors until you have configured the associated rule.*

4 Draw **arrows** between the flowchart task, your selected task schema boxes, and the flowchart output. You may only draw arrows between tasks that represent Transitions you have already configured. Attempting to draw an arrow between two task schemas without a Transition linking them will result in an error. If you have added a router to your template flowchart, draw arrows from the input task into the top of the router, and from the bottom of the router to all output tasks.

5 Check the “Users can modify the flowchart when tasks are created” option if you’d like to allow users to edit their flowcharts.

Checking the “Users can modify the flowchart when tasks are created” option will allow users to draw a custom flowchart when creating a new task group. This will not have any lasting effect on the underlying task schema. You may also leave the template flowchart blank. If the template flowchart is left blank or the above option is checked, users will be prompted to draw the flowchart when executing the task group. They will perform the same actions as shown below in the configuration modal, pulling from the task schemas and transitions defined during the schema creation process. If you set a template flowchart and do not check the option to allow modification, users will be forced to follow the template flowchart when executing their task group.

6 Click **Submit** to save the entire flowchart configuration table.

Your flowchart task schema is now complete!

Configure a Flowchart Router

Now that you've configured a complete flowchart, you may insert **Routers** to add logic to your flowchart's branch points. Once it is placed at a branch point, configure a given router to read a task's metadata and determine which branch it should be mapped to. Routers allow for the configuration of multiple paths within the same workflow and limit the end user's need to manually edit the template flowchart.

Follow these steps to add a router to your template flowchart:

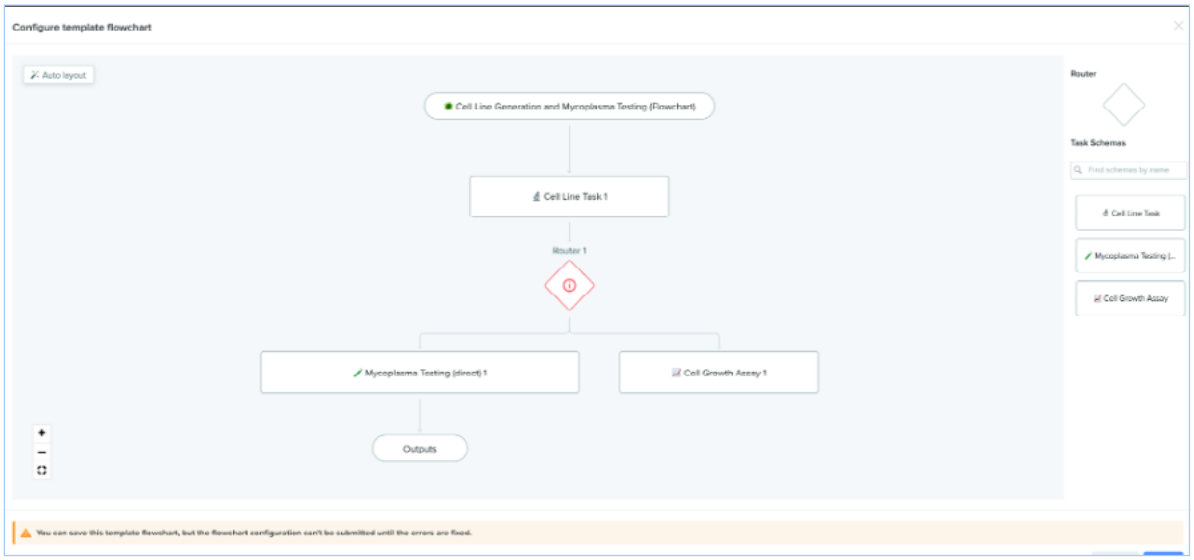
1 Begin editing the template flowchart.

a. Navigate to the Flowchart section of the Task schema configuration page, click **"Edit"**.
b. Select the **"Template Flowchart"** sub-tab.
c. Click the **pencil button** to edit the template flowchart.

2 Drag the diamond-shaped **router** object onto the template flowchart.

3 **Connect tasks** to the router

a. Draw an arrow from exactly one source node to the top of the router.
b. Draw arrows from the bottom of the router to at least two destination nodes.



4 Hover over the router and select the **"Configure"** button to define the router's logic.

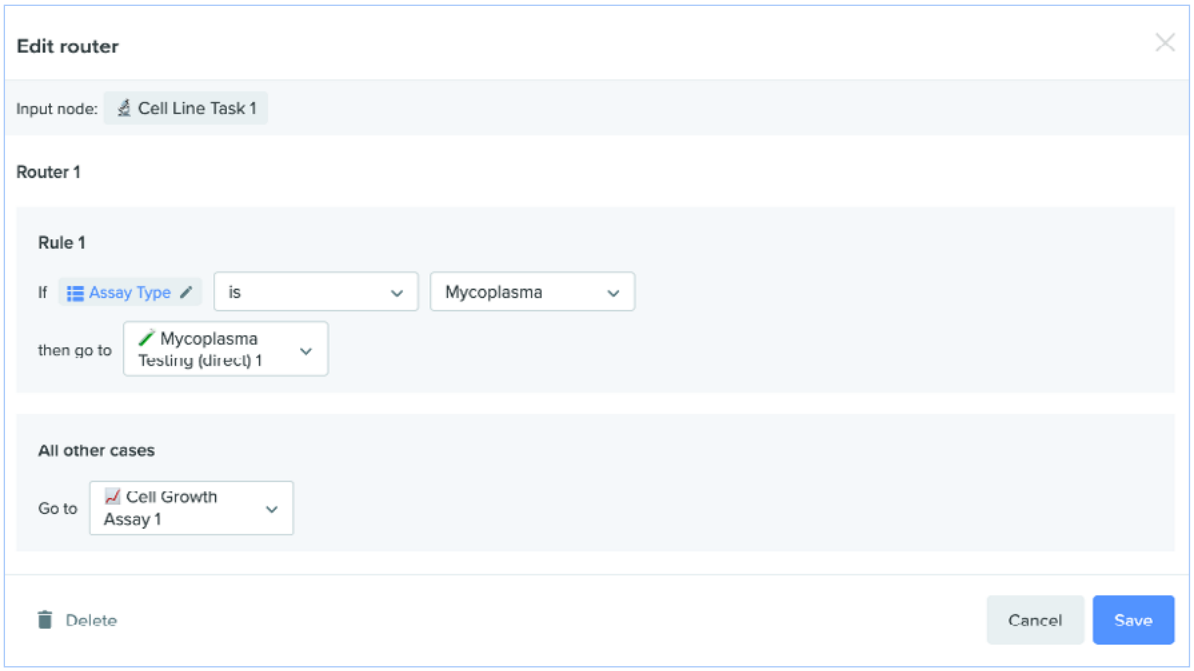
5 **Set logic rules** for each destination node connected to the router. There must always be one node that accepts all other cases not covered by the configured logic.

a. Click "Lookup Value" and use Benchling's lookup functionality to select one of the input task's metadata fields to evaluate.

b. Click the "select operator" dropdown to set the logical operator.

c. Click the "select value" dropdown to choose the desired metadata value for that rule.

d. Click the "select next step" dropdown and choose one of the destination nodes in the flowchart.



6 Repeat this process for all other routes in the router.

7 Set the destination node in the section marked **"All other cases"**.

8 Click **Save**.

The router will now map tasks to the destination nodes based on the logic you defined. If an input task does not meet any of the routing criteria, it will be mapped to the destination node set to handle “all other cases”. Use routers to control the flow of information throughout your flowchart and make things easier for your users.

Your flowchart task schema is now complete!

Initiate a workflow

Create a task group to represent your workflows. You can create task groups in the Workflows dashboard or in a structured table.

Workflows application

To create a task group from the Workflows dashboard:

1. Click the **Workflows** icon in the left-side menu.
2. Click **+** and select the schema to create the task group in.
3. Create tasks by completing the Tasks table.
   - Each row of the Tasks table corresponds to one task.
   - For each row, fill in the relevant task parameters and assignees, if applicable.
4. Click **Create** to create the task group and corresponding tasks.
5. Click **Metadata** to add users as Watchers. They will receive notifications regarding task group status changes.

Structured table

You can create task groups from these structured tables:

Plate Creation	Output Table	Registration
Task Table	Transfer	

To create a task group from a structured table:

1 Click the **Create workflow tasks** icon at the top of the table.

2 Select the desired task schema from the drop-down menu.

3 Create tasks by completing the Tasks table.

- For each row, fill in the relevant task parameters and assignees, if applicable.
- If the structured table contains an entity or inventory item and the chosen task group contains at least one field which accepts this type of entity or inventory item, Benchling will automatically add the item to the first acceptable field.

Execute and complete a task

After creating a task group, you can execute tasks in notebook entries or in the task group. How you complete a task depends on its execution type. If its associated task schema supports the:

Entry execution type
You need to execute the task and associate it with a new or existing notebook entry to complete it.

Direct execution type
You can manually update its status in the task group to complete it. Tasks using this execution type are not executed into entries.

Flowchart execution type
When executed, the first sequential step of the flowchart is initiated automatically.

Execute a task

1 In the Workflows application, click **>** in the top-right corner of the panel to expand the Workflows dashboard.

2 Select Pending tasks. If you are executing multiple tasks, they must be of the same task schema.

3 Click **Execute** in the top-right corner.

The selected tasks execute into a new entry from the notebook template configured in the task schema. To execute tasks via this entry:

1 Click **Execute** from the Workflows dashboard.

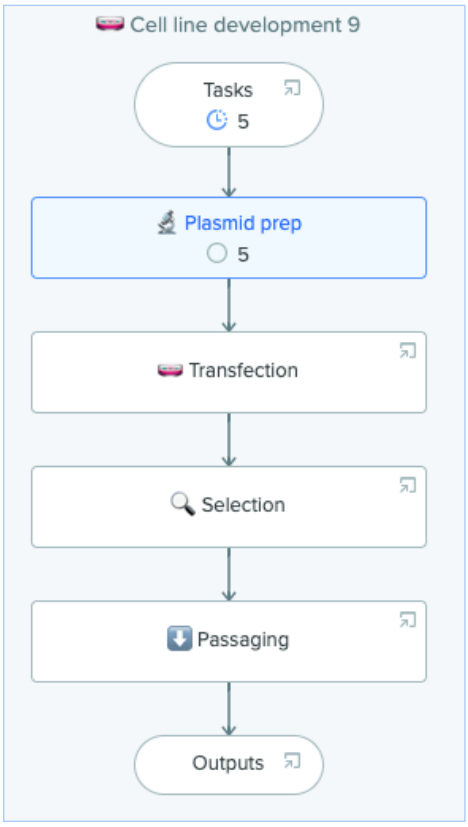
2 Enter the entry name.

3 Select the Project or Folder the entry will be associated with.

4 Click **Execute** to continue.

Note: For flowchart task groups, the first step of the flowchart opens automatically upon execution at the flowchart level.

View of pending tasks in the second node of the flowchart after initiation.



Complete a task

After executing a task, a new entry will be created with the selected tasks present as rows in the Tasks table.

1. Complete the entry to fulfill the task.

2. When the task's deliverable is created, add the entity, container, value or plate intended as the output to the Outputs table.

3. Fill in the required Task column to specify the task related to this output. Each output may only link to one task.

   If the task lookup was configured in the Workflow Schema, you can use the **Link Output to Task** button to automatically associate the tasks with their outputs.

4. Click **Submit** on the Outputs table to create outputs. You can modify values and re-submit if needed.

5. The method to indicate the status is complete depends on the status lifecycle specified in the task schema:

   - **Entry:** Manually update the Status column in the entry's Tasks table or the task group to Completed.
   - **Entry review:** Send the entry for review. Once accepted, the status will automatically change to Completed.

Update a task

In the Tasks table at the top of your execution entry or in the task group, click the task's cell in the Status column and select a status from the drop-down menu. The available statuses will depend on the task's execution and lifecycle type and its current status.

Options include Planned, Invalid, In Progress, Failed, Cancelled, Completed, and may include Completed (after review).

Workflows notifications

As tasks move through status changes and assigned users, Workflows sends automatic email notifications to relevant roles. This section explains:

Notification triggers and recipients	Customizing your notifications

Notification triggers and recipients
Use the table below to understand what events trigger notifications and which roles are notified. When you take an action, you will not receive a notification, even if you are in these roles.

Task group event	Assignee	Previous assignee	Responsible team	Watchers
The Assignee field is changed	✓	✓	N/A	✓
A task is created	✓	N/A	✓	✓
A task is executed into an entry	✓	N/A	N/A	✓
Status is changed to: • Canceled • Completed • Failed • Invalid	✓	N/A	N/A	✓

Flowchart event	Responsible team	Watchers
A flowchart task is created	✓	✓
Flowchart status is changed to: • Canceled • Completed • Failed	N/A	✓

Customize notification recipients

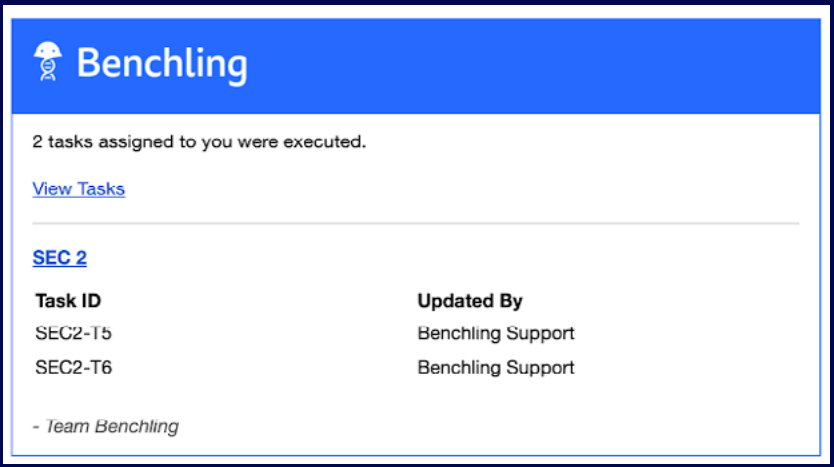
If you have Write permissions on a task group project, you can add watchers to ensure the right people are notified when important actions are taken.

To edit task group watchers:

1. In the workflow, click the Metadata tab.
2. Hover under the Watchers field and click the pencil icon.
3. Enter a user and select their name from the list. To remove a user, click the X next to their name.
4. Click the ✓ to save.

Note: The task group creator is automatically set as a watcher.

The responsible team is assigned when the task group is created and cannot be updated. To learn more, visit Configure a Workflow Schema: Basic Information.



Example of an email notification received when two Tasks assigned to the receiver were Executed by Benchling Support

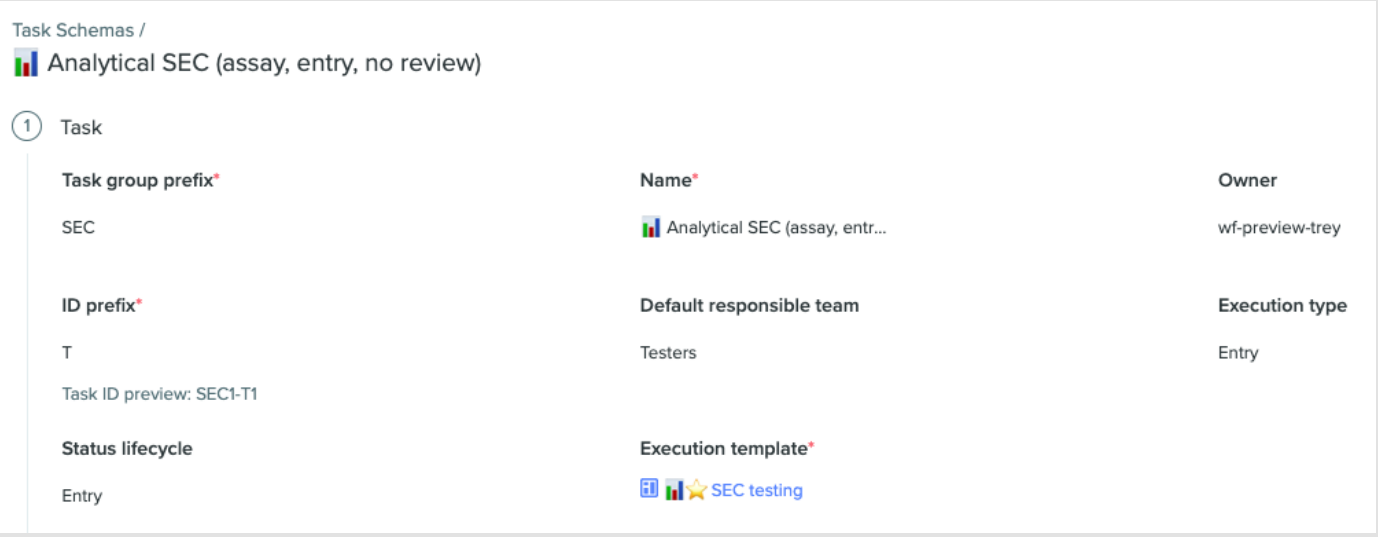
Case studies

Analytical SEC

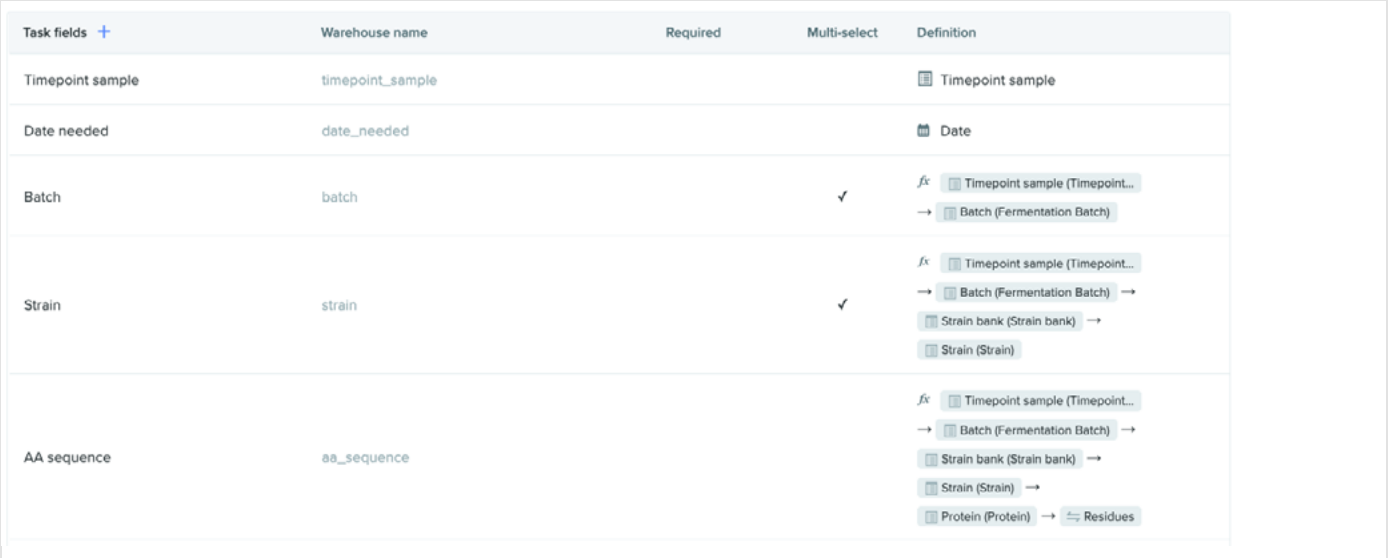
Workflows supports a scientist requesting an analytical team perform an SEC on a protein sample.

Task Schemas

Configure the task schema for an Entry type execution.



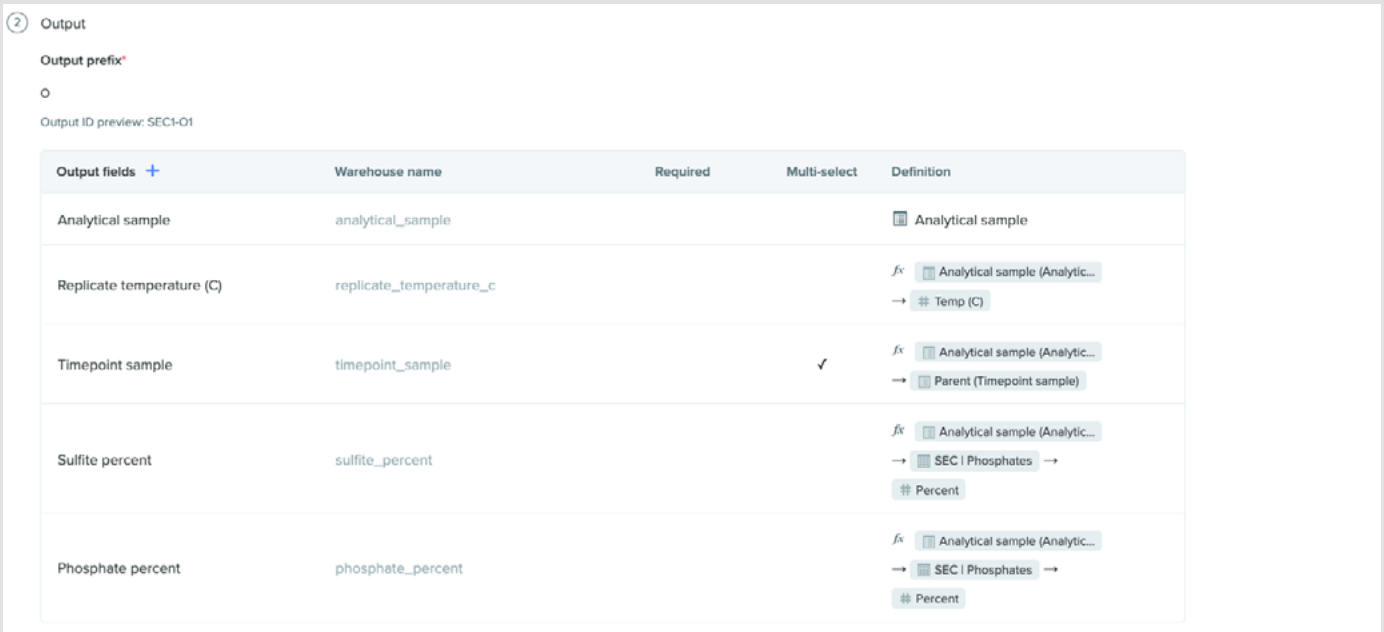
Add a task field for your timepoint sample and the date you need the results by. Optionally, add snapshot fields to pull relevant information such as Strain and AA Sequence from the timepoint sample.



Task fields +	Warehouse name	Required	Multi-select	Definition
Timepoint sample	timepoint_sample			Timepoint sample
Date needed	date_needed			Date
Batch	batch		✓	fx Timepoint sample (Timepoint... → Batch (Fermentation Batch)
Strain	strain		✓	fx Timepoint sample (Timepoint... → Batch (Fermentation Batch) → Strain bank (Strain bank) → Strain (Strain)
AA sequence	aa_sequence			fx Timepoint sample (Timepoint... → Batch (Fermentation Batch) → Strain bank (Strain bank) → Strain (Strain) → Protein (Protein) → Residues

Output Table

Add an output field for the analytical sample. Add snapshot fields that will pull results data filed to the sample in the execution entry into the output table.



2 Output

Output prefix*

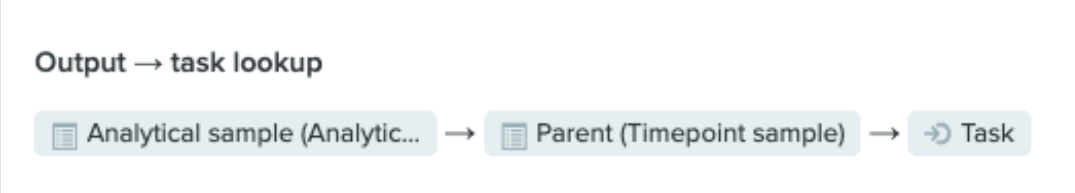
O

Output ID preview: SEC1-O1

Output fields +	Warehouse name	Required	Multi-select	Definition
Analytical sample	analytical_sample			Analytical sample
Replicate temperature (C)	replicate_temperature_c			fx Analytical sample (Analytic... → # Temp (C)
Timepoint sample	timepoint_sample		✓	fx Analytical sample (Analytic... → Parent (Timepoint sample)
Sulfite percent	sulfite_percent			fx Analytical sample (Analytic... → SEC | Phosphates → # Percent
Phosphate percent	phosphate_percent			fx Analytical sample (Analytic... → SEC | Phosphates → # Percent

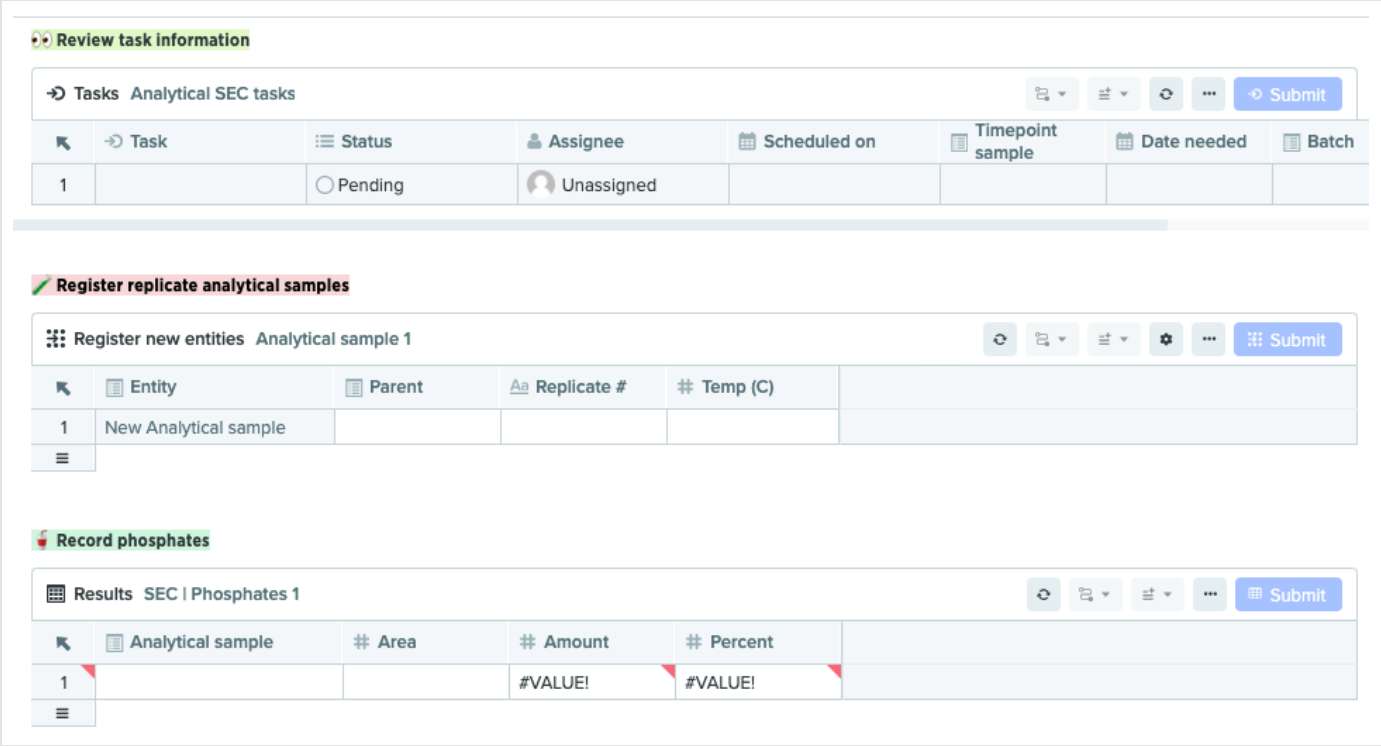
Task

Create a task lookup linking the analytical sample to its parent timepoint sample.



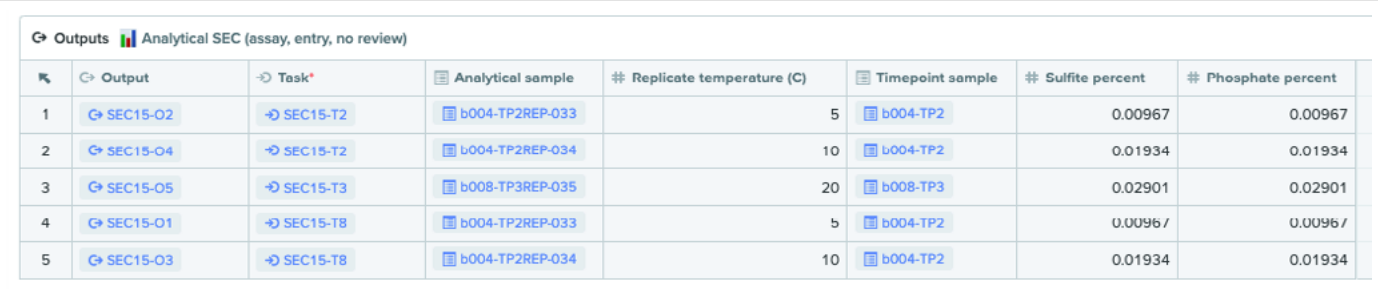
Execution Template

Create an execution template that begins with registering the analytical samples as children of the timepoint samples. Add results tables such as phosphates and sulfites.



Completed Outputs

The completed Outputs table will be filled with the linked tasks, analytical samples, and relevant results values.



Outputs | Analytical SEC (assay, entry, no review)

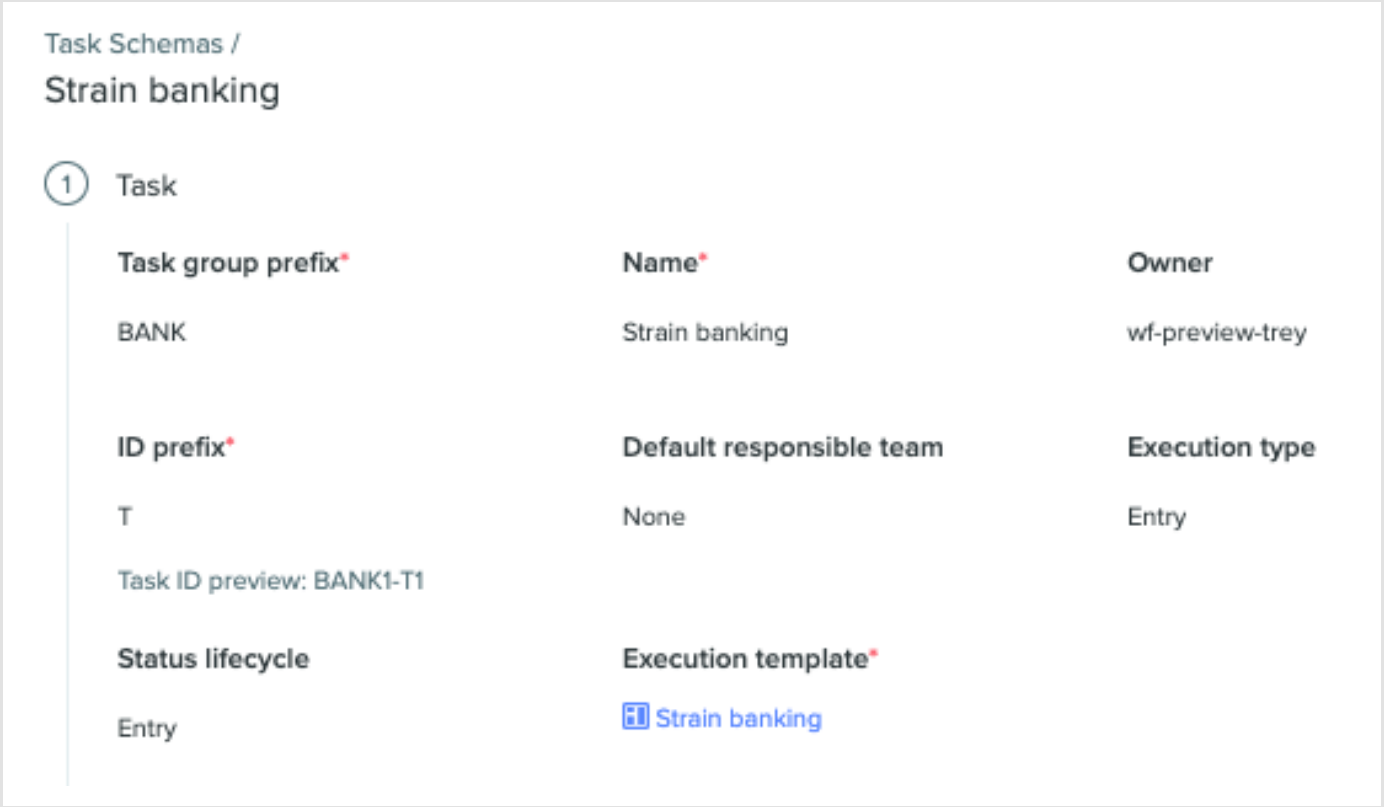
	Output	Task*	Analytical sample	Replicate temperature (C)	Timepoint sample	Sulfite percent	Phosphate percent
1	SEC15-O2	SEC15-T2	b004-TP2REP-033	5	b004-TP2	0.00967	0.00967
2	SEC15-O4	SEC15-T2	b004-TP2REP-034	10	b004-TP2	0.01934	0.01934
3	SEC15-O5	SEC15-T3	b008-TP3REP-035	20	b008-TP3	0.02901	0.02901
4	SEC15-O1	SEC15-T8	b004-TP2REP-033	5	b004-TP2	0.00967	0.00967
5	SEC15-O3	SEC15-T8	b004-TP2REP-034	10	b004-TP2	0.01934	0.01934

Strain Banking

Workflows supports confirming shipments.

Task Schemas

Configure the task schema for an Entry type execution.



Add task fields for the strain, the number of containers and the date needed.

Task fields +	Warehouse name	Required	Multi-select	Definition
Strain	strain			Strain
Number of containers	number_of_containers			Integer
Date needed	date_needed			Date

Output Table

Add output fields for the container and snapshot fields for the strain bank and volume.

Output

Output prefix*

O

Output ID preview: BANK1-O1

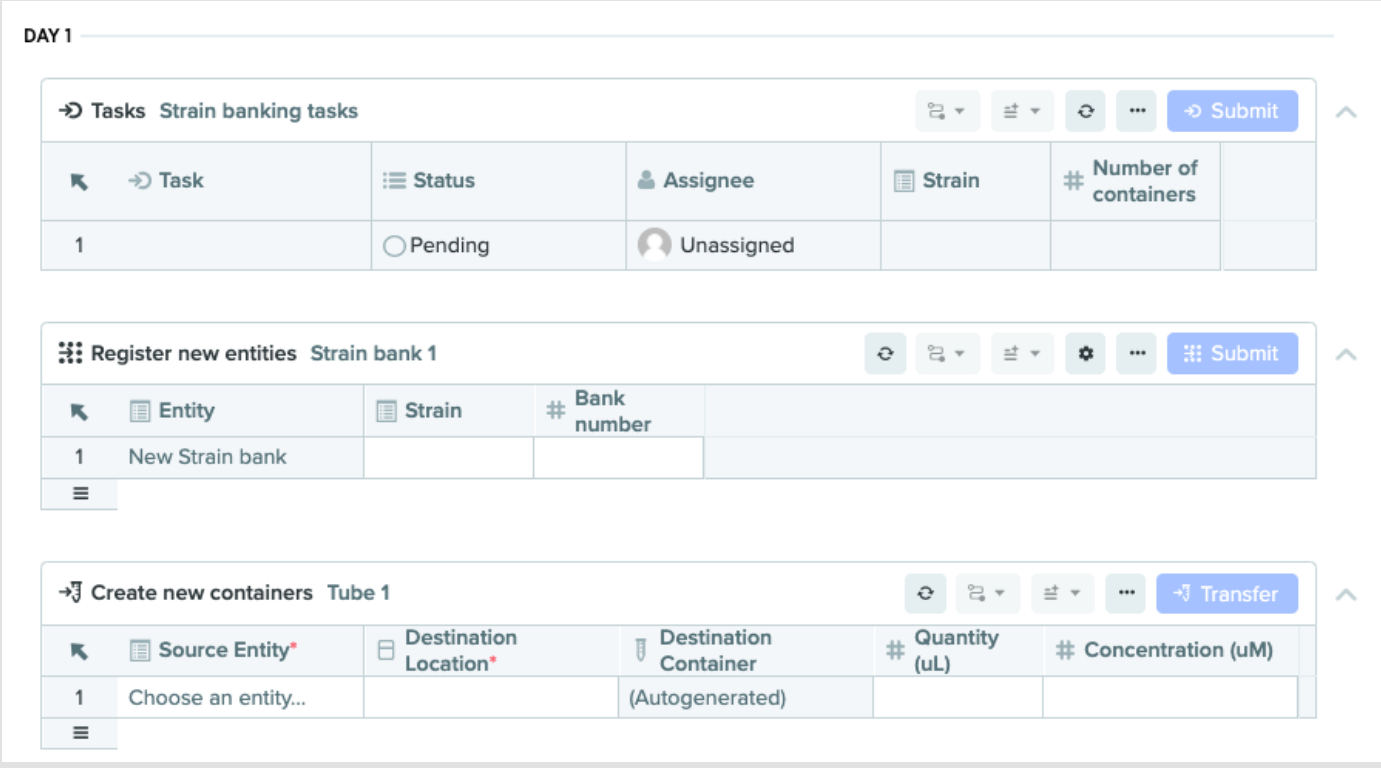
Output fields +	Warehouse name	Required	Multi-select	Definition
Container	container			Tube
Strain bank	strain_bank		✓	fx Container (Tube) → Strain bank
Volume (uL)	volume_ul			fx Container (Tube) → Volume (uL)

Task Lookup

Configure a task lookup to look at the container, the container's strain bank and the parent strain to link to a task.

Execution Template

Create an execution template that begins with registering the strain bank samples as children of the strain. Add a transfer table to create the container and store it in a location.



Completed Outputs

The completed outputs table will be filled with linked tasks, the containers holding the strain banks, and the volume in those containers.

Outputs Strain banking

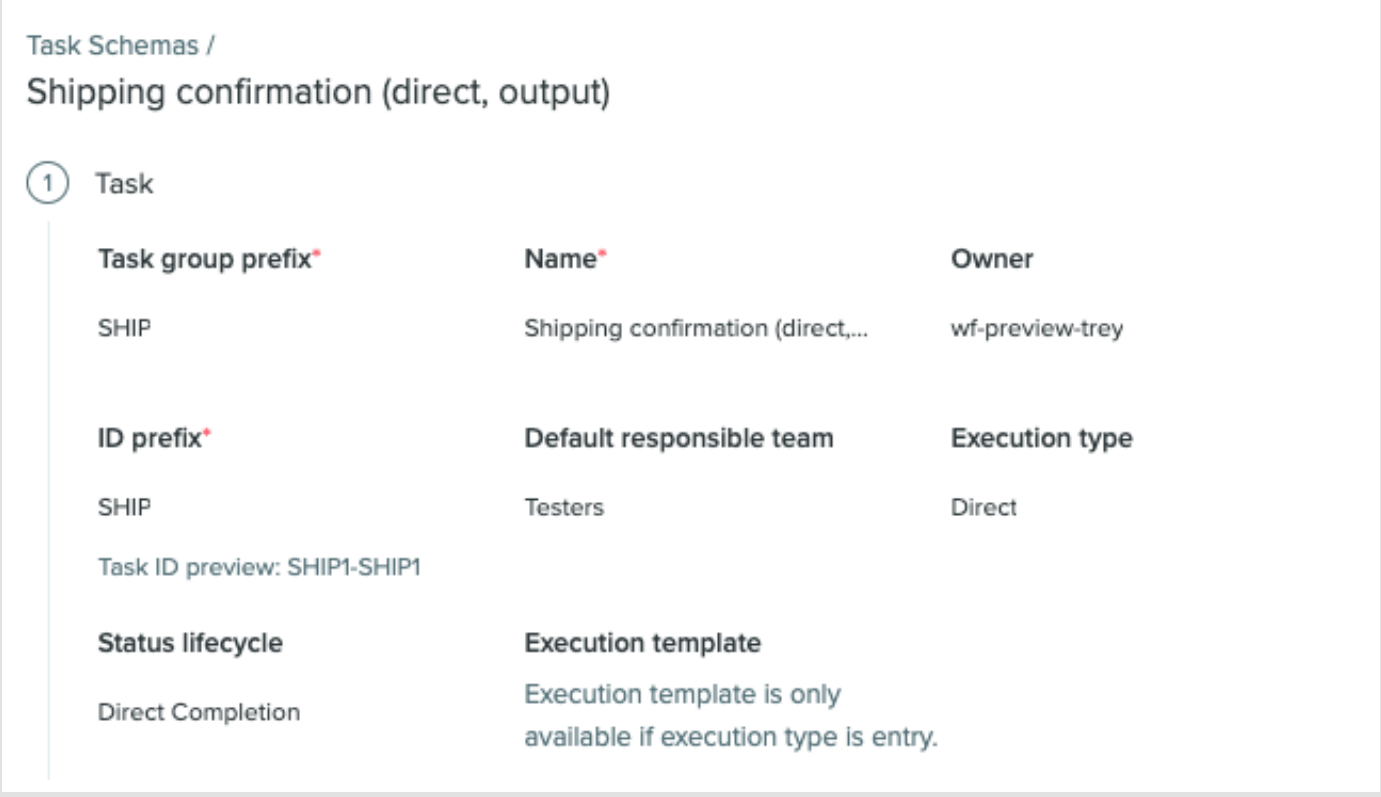
	Output	Task*	Container	Strain bank	Volume (uL)
1	BANK6-O3	BANK6-T1	t044	s003-BANK1	50
2	BANK6-O1	BANK6-T2	t042	s004-BANK1	50
3	BANK6-O2	BANK6-T2	t043	s004-BANK1	50

Shipping Confirmation

Workflows supports confirming shipments.

Task Schemas

Configure the task schema for a direct execution type. Execution of these tasks will not require a notebook entry.



Add task fields for vendor order number, date order placed, department, and a boolean dropdown for hazardous materials.

Task fields +	Warehouse name	Required	Multi-select	Definition
Vendor order number	vendor_order_number			Aa Text
Date order placed	date_order_placed			Datetime
Department	department		✓	PLM - product area
Hazardous materials	hazardous_materials	✓		Boolean

Output Table

Add outputs fields for the FedEx shipment number, expected delivery date, and receiving user.

2 Output

Output prefix*

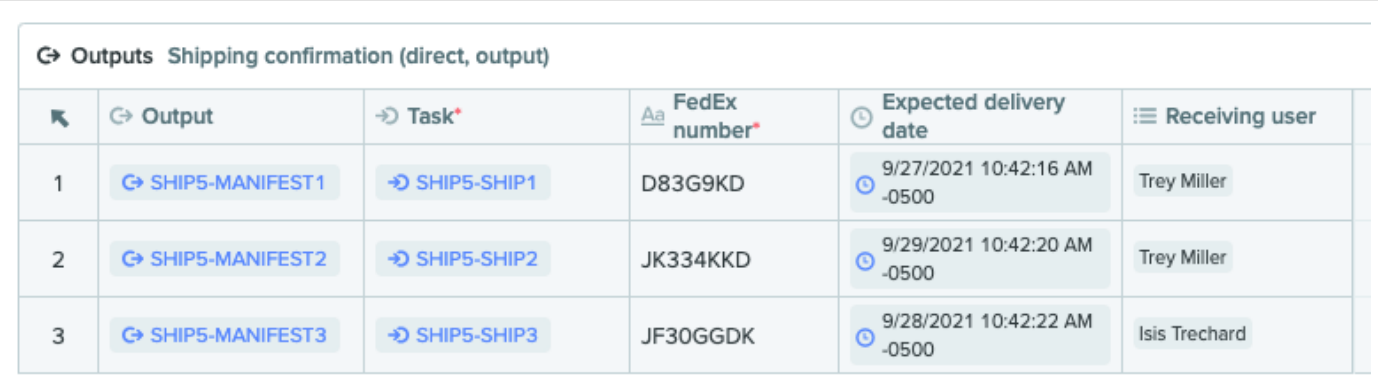
MANIFEST

Output ID preview: SHIP1-MANI...

Output fields +	Warehouse name	Required	Multi-select	Definition
FedEx number	fedex_number	✓		Aa Text
Expected delivery date	expected_delivery_date			Datetime
Receiving user	receiving_user			Plm - users

Completed Outputs

The completed outputs will contain the tasks and the output fields specified. This table will be filled out directly in the task group.



Outputs Shipping confirmation (direct, output)

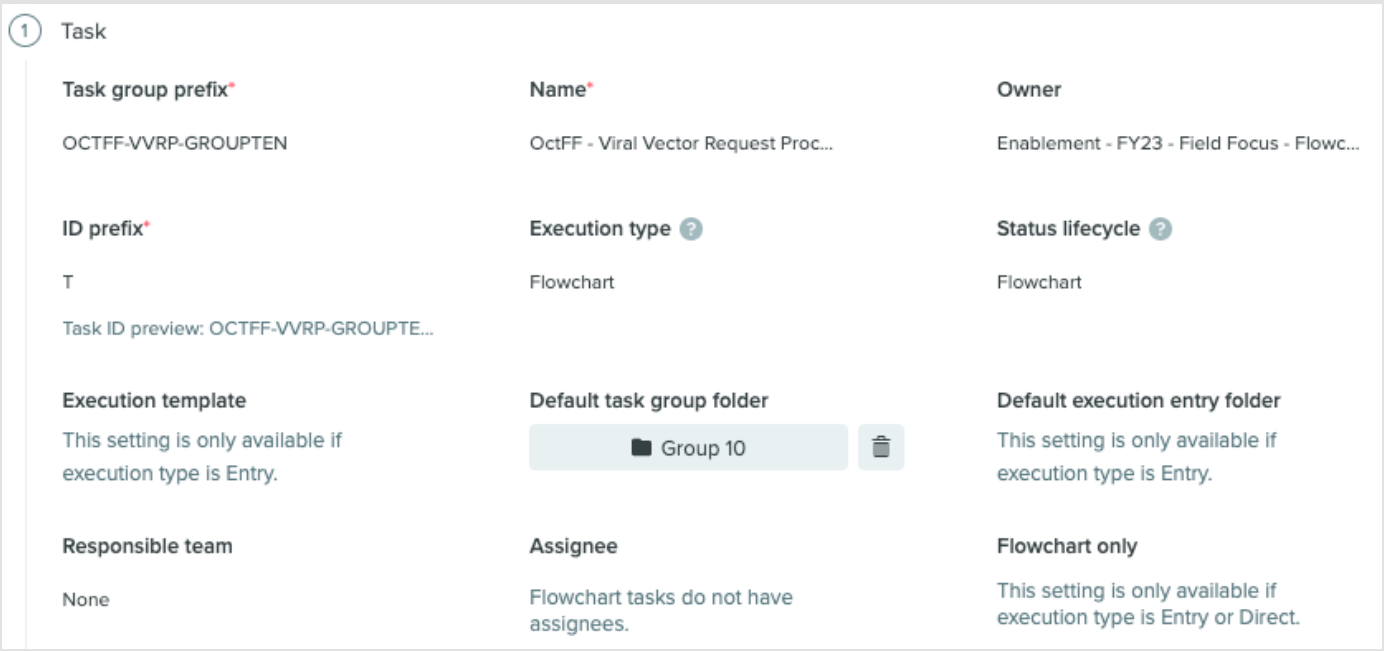
	Output	Task*	FedEx number*	Expected delivery date	Receiving user
1	SHIP5-MANIFEST1	SHIP5-SHIP1	D83G9KD	9/27/2021 10:42:16 AM -0500	Trey Miller
2	SHIP5-MANIFEST2	SHIP5-SHIP2	JK334KKD	9/29/2021 10:42:20 AM -0500	Trey Miller
3	SHIP5-MANIFEST3	SHIP5-SHIP3	JF30GGDK	9/28/2021 10:42:22 AM -0500	Isis Trechard

Viral Vector Production Flowchart

Workflows supports a multi-step viral vector production process. This flowchart links several task schemas together allowing the scientist to register component samples, generate vector lot containers, and record quality metrics.

Task Schema

Configure the task schema for a flowchart execution type.



Add task fields for Plasmid, desired plasmid prep type, number of containers, Virus name, requested virus lot volume, and minimum titer required.

Task fields +	Warehouse name	Required	Multi-select	Definition
Plasmid	plasmid	✓		Plasmid
Plasmid Prep Type	plasmid_prep_type	✓		Plasmid Prep Type
Number of Containers	number_of_containers			Integer
Virus Name	virus_name			Text
Virus Lot Volume Requested (mL)	virus_lot_volume_requested_ml			Decimal
Minimum Titer (vg/mL)	minimum_titer_vgml			Decimal

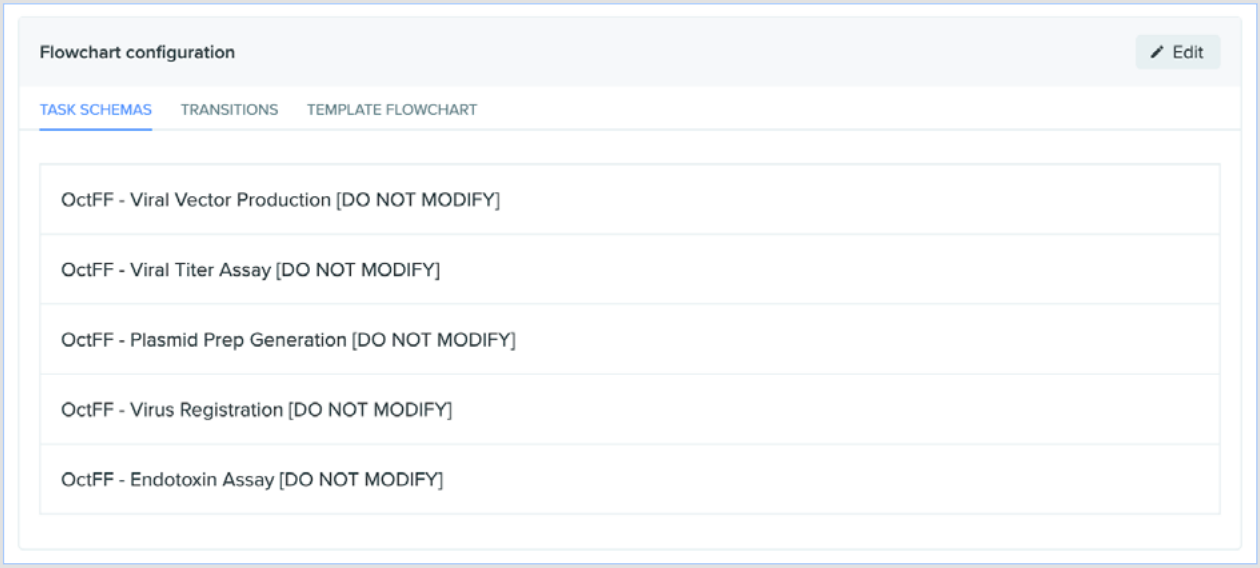
Output Table

Add output fields for the virus lot container, final titer, virus lot (automatically computed from the container), and endotoxin amount.

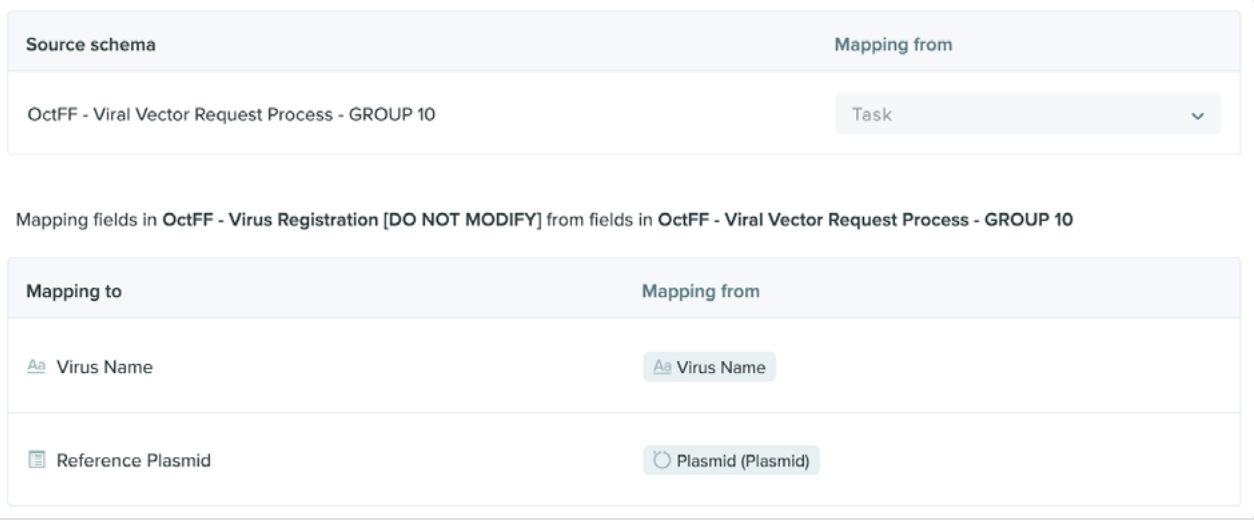
Output fields +	Warehouse name	Required	Multi-select	Definition
Virus Lot Container	virus_lot_container			Any inventory
Final Titer (vg/mL)	final_titer_vgml			Decimal
Virus Lot	virus_lot			fx Virus Lot Container → Viral Vector → Latest content
Endotoxin (EU/mL)	endotoxin_euml			Decimal

Flowchart

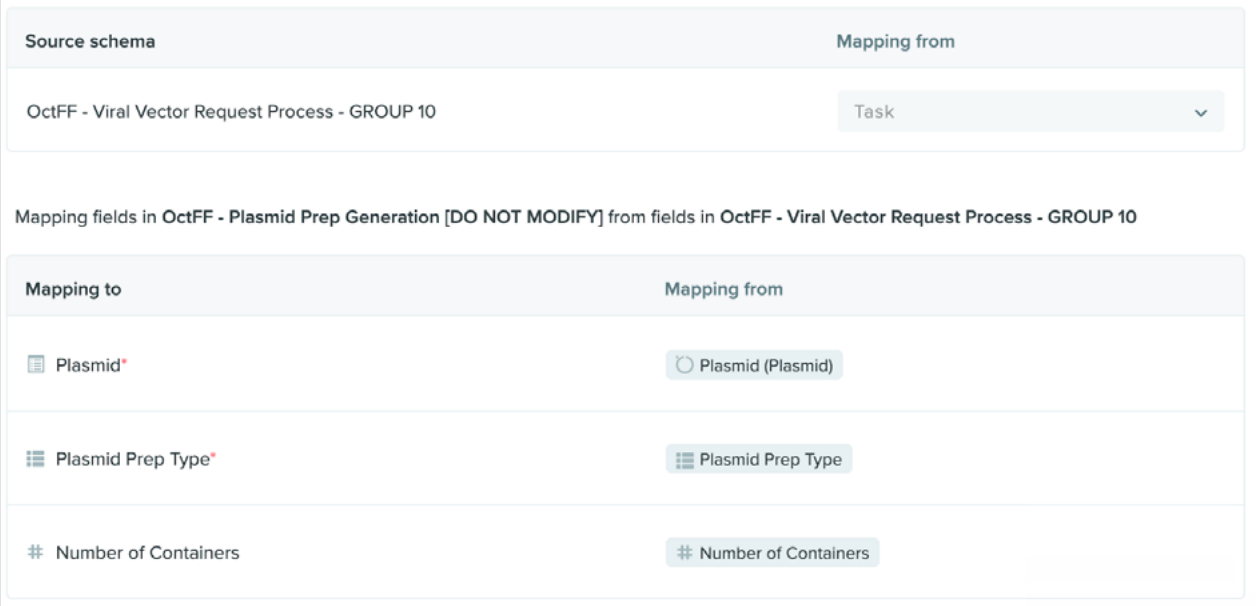
Choose the task schemas that belong in the flowchart, create transitions between them, and design a template flowchart.



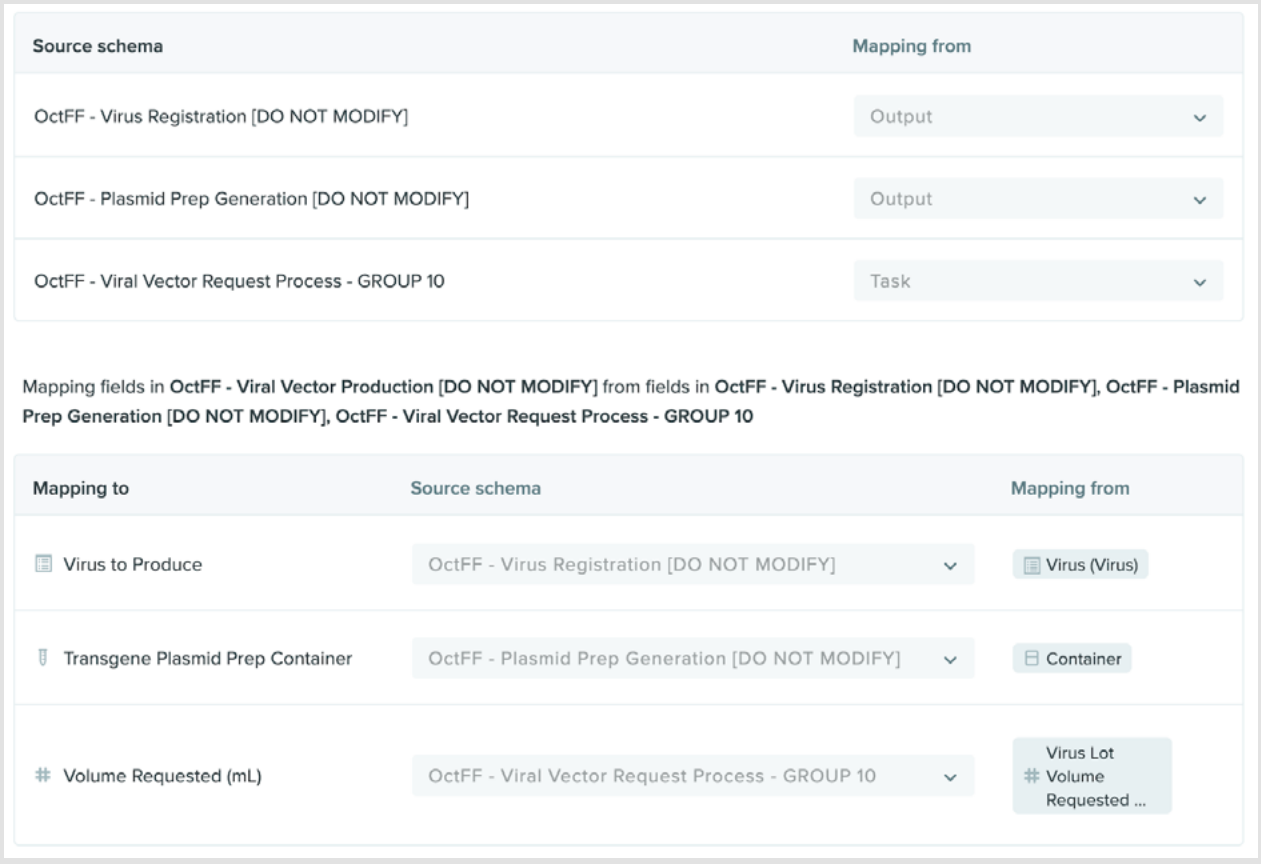
List of Task Schemas in the Flowchart



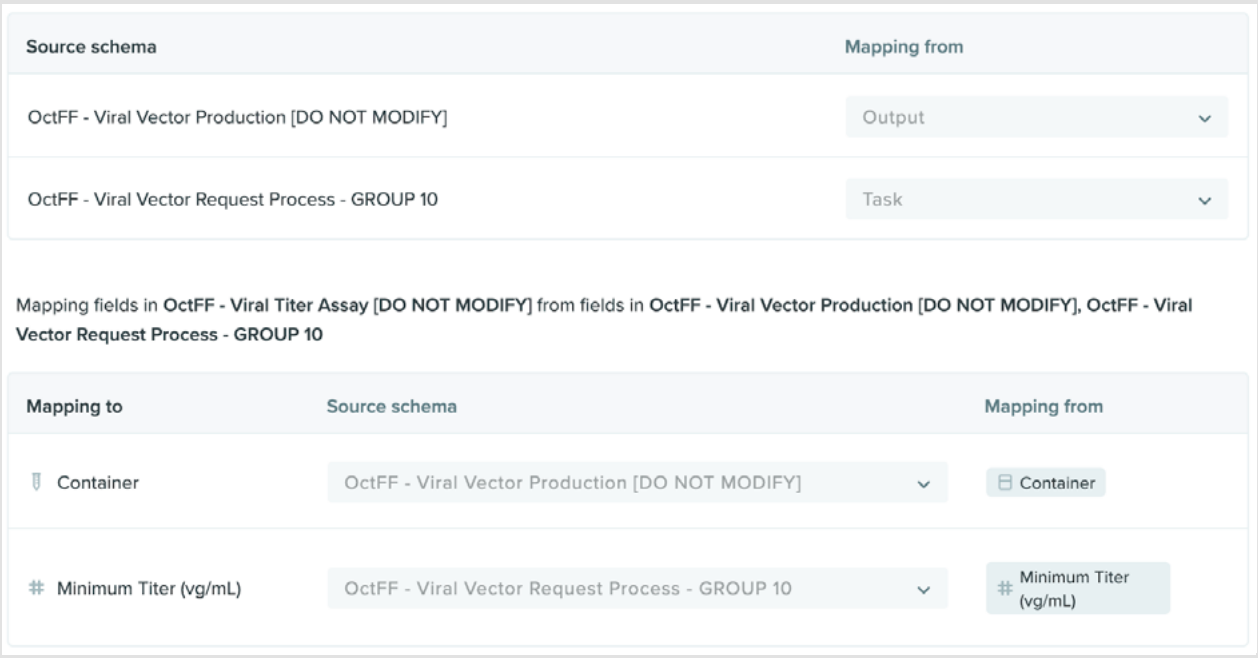
Transition from Flowchart Task table → Virus Registration Task



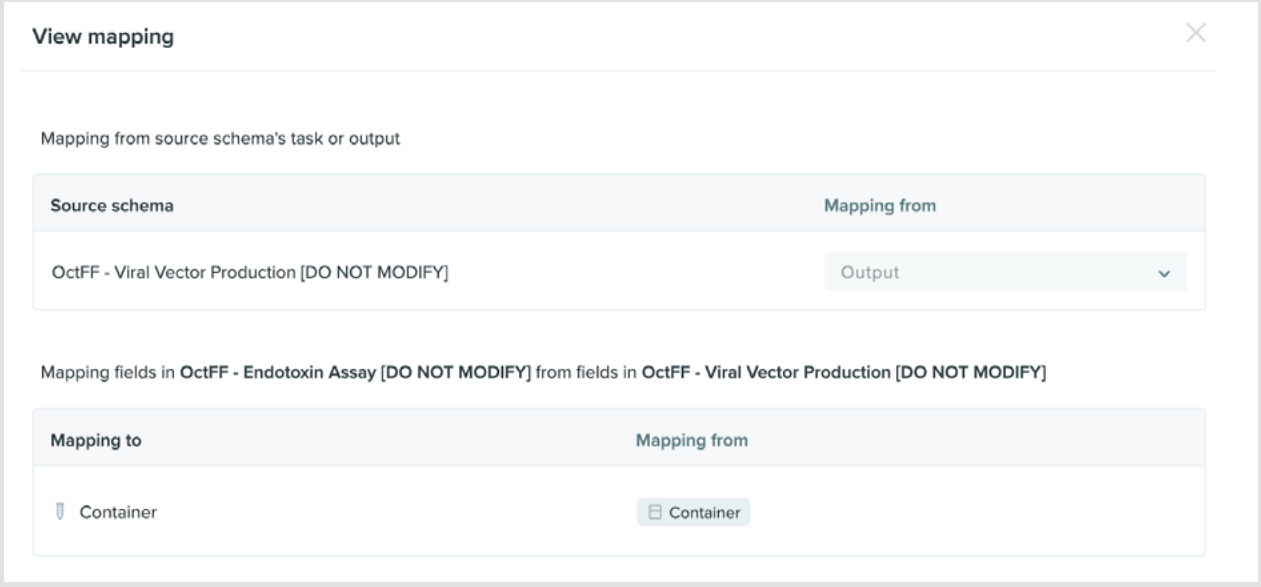
Transition from Flowchart Task table → Plasmid Prep Generation Task



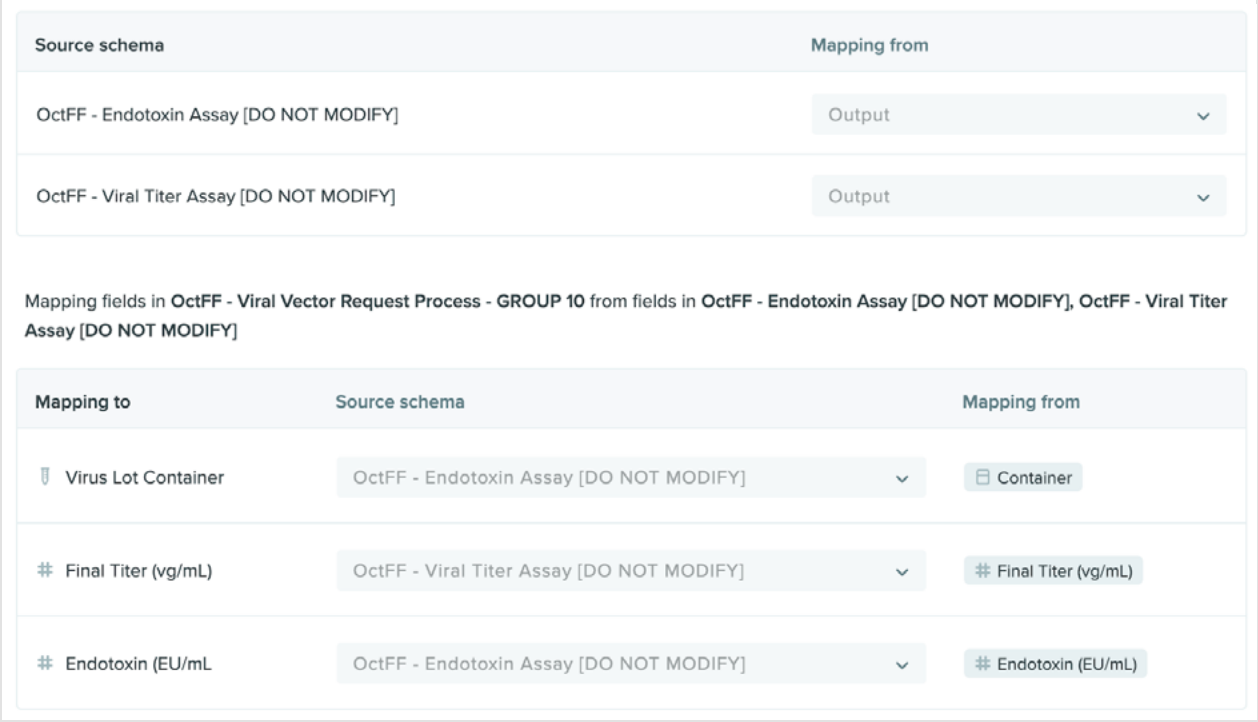
Transition from Flowchart Task table, Virus Registration Task, and Plasmid Prep Generation Task → Viral Vector Production Task



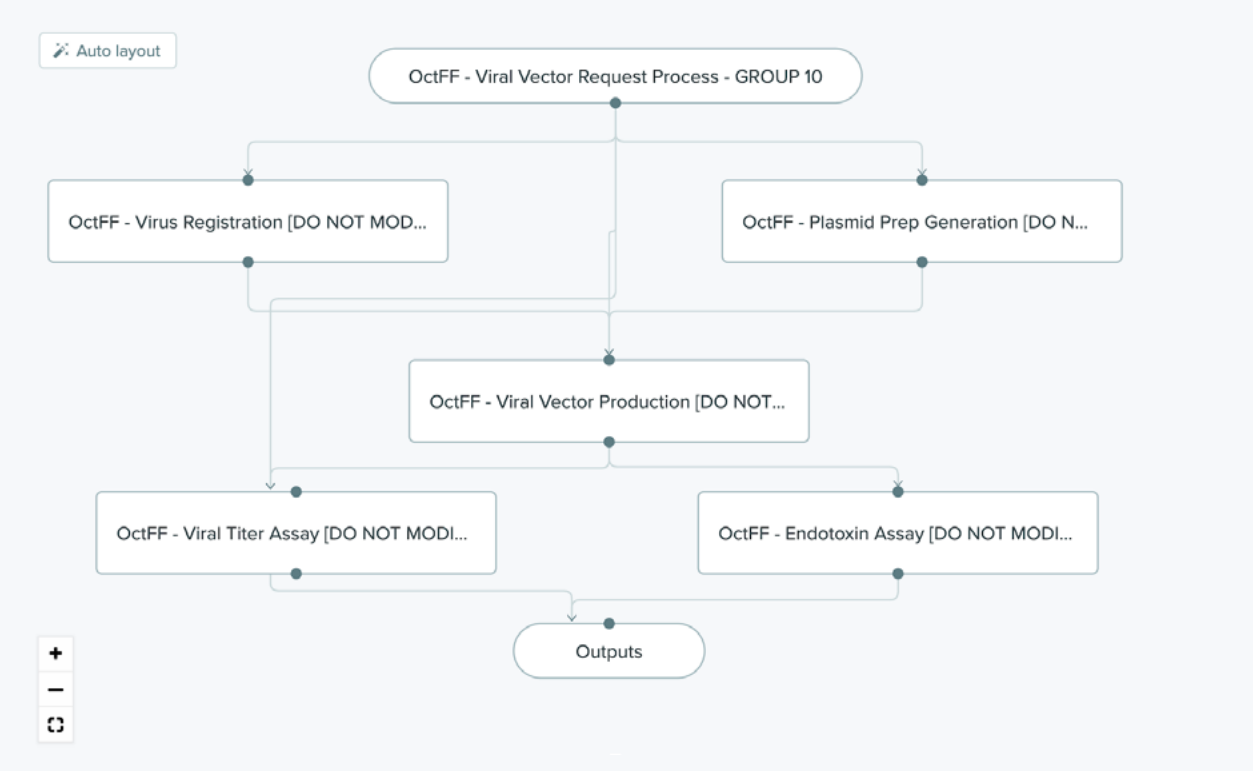
Transition from Viral Vector Production Task → Viral Titer Assay Task



Transition from Viral Vector Production Task → Endotoxin Assay Task



Transition from Viral Titer Assay Task and Endotoxin Assay Task → Flowchart Output table



Template Flowchart showing task organization