Lab Support 2

Checklist for an Experiment

Basically, there are two types of experiments, the well-planned experiments and the poorly-planned ones. And why are we so eager for you to understand the difference? See for yourself.

The well-planned experiment

- resources well used
- energy-efficient
- time-efficient
- **time and space for noticing the unexpected**
- opportunities taken
- time for ideas
- pleasant experience

The poorly-planned experiment

- waste of resources
- waste of energy
- waste of time
- things going wrong that could have been avoided
- opportunities missed
- no scope for creativity
- stressed atmosphere

This is why an experiment has to be planned intelligently. In this Learning Toolbox, we will walk through a hypothetical experiment. Things will be different with your own experiments, but you will get the idea.

Now, let's say, you have a **research question** and you have already decided what **methods** you are going to use, so you know what kind of experiment you will perform.

Before we enter the timeline, a few points to consider beforehand.

Plan towards a publication

- ☐ How many samples will you need?
- ☐ How many replicates will you need for each sample?
- ☐ Will these be technical or biological replicates?
- ☐ Statistical analysis: How many **n numbers** will you need?
- ☐ What controls will you need? Try to include negative as well as positive controls.
- ☐ What could be possible questions of reviewers of a journal?
- ☐ What journals would be suitable for your study?

Set up a story

- ☐ What is the problem / question?
- ☐ How could you find a possible solution to solve the problem or answer the question?
- ☐ What does your solution /answer mean in the context of findings so far and already existing knowledge?
- ☐ How can the scientific community or any other community (e.g. medical research) benefit from your findings?
- ☐ What would be possible limitations of your study?
- ☐ Suggest some possible next steps or an outlook to your study.

You will not be able to answer all of this in the starting phase of your study, but it is extremely important to ask these questions, and note down fragments of answers, even if they turn out to be not entirely right.

Samples and groups

When you set up samples and groups, keep the following points in mind

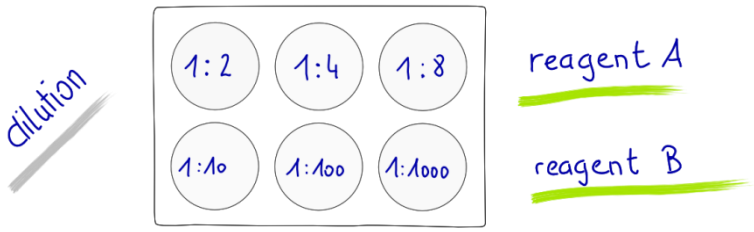
- ☐ What are your resources?
- ☐ What is your financial feasibility?
- ☐ What could be possible drop-out rates?

Now, let's enter the timeline!

weeks to months | days to weeks | 1 week | 1 - 2 days | day 0 | after

WEEKS TO MONTHS before your experiment

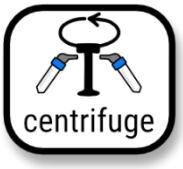
- ☐ **Draw schematics of plates and flasks**
  - Note down how many plates, flasks etc. you will need.
  - Set up a pipetting plan in a way that pipetting will be easy and not prone to error.



- ☐ **Draw a flow-chart of your experiment (could be overlapping with previous point)**
  - What reagents will you need?
    - Are they available in your lab or do you need to order them?
    - Note down the expected delivery dates.

- If they are available in your lab:
  - Check the expiry date.
  - Are there sufficient amounts available?
  - Are they still sterile (if needed).
  - Check with their molecular weight to be sure that they are the right reagents.

weeks to months | days to weeks | 1 week | 1 - 2 days | day 0 | after



- ☐ **What pieces of equipment will you need?**
  - Are they available in your lab?
  - Are they working?
  - Do they need maintenance?
  - Do you have to book them in advance?
  - Do you have to inform anyone that you are going to use them?
  - Do you need a training for them?
  - Whom do you have to contact for using that piece of equipment and for the training?
- ☐ **Check if you need to order materials such as plates and flasks etc.**
- ☐ **Depending on how things are done in your lab, you either**
  - order them yourself, or
  - you tell the person who does the ordering that you need these materials, or
  - if they are available, reserve them for yourself and/or reorder them, or have them reordered. Same with reagents.

DO NOT start looking for them on the day of your experiment, when you need them. If they are not available then, you will be in trouble.

weeks to months | days to weeks | 1 week | 1 - 2 days | day 0 | after

DAYS TO WEEKS before your experiment

- ☐ Finish all calculations for dilutions, preparations of reagents, media, etc.
- ☐ Set up orders of files for all documents in your computer system.
- ☐ Prepare all reagents that can be kept for this period of time.
- ☐ Finish the detailed protocol or, if you were given a protocol, make all necessary amendments in a way that they can be traced back.
- ☐ For every reagent, note down company, catalog number, lot number etc.
- ☐ For equipment, note down the same, and add type and serial number, and for any software you will use, the exact version number.
- ☐ For preparations, write down the concentration, how to calculate them, and how to prepare them.

!

Run-through

- ☐ Take your time, and go through your experiment, step-by-step. The more time you invest here, the more time you will save later!

Time-table

- ☐ Note down estimated times of how long each step in your protocol will take.

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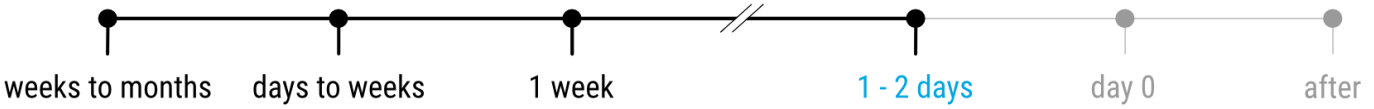
Thaw cells / isolate cells / expand cells

- ☐ Start taking care of your cells, so that you will not run out of cells in the middle of your experiments.
- ☐ Use your flow-charts to calculate the cell numbers you will need during the course of your experiments.
- ☐ Depending on the cell types, you will be working with, make sure that you have
  - enough cells
  - enough donors
  - enough cell vials in your working cell bank
  - and the right passage numbers for finite cell lines

1 WEEK before your experiment

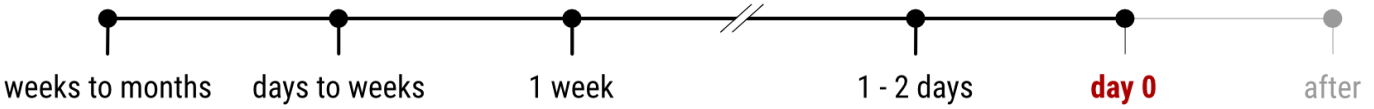
- ☐ Check that
  - all deliveries have arrived,
  - all reagents are prepared, and
  - the protocols are ready.
- ☐ Prepare a short, condensed protocol from your detailed protocol, which only lists the steps you will actually need during your experiments.
- ☐ Mark the steps of your protocols where you should take pictures. You may need them for your protocol, for presentations or for your publication.
  In some cases, you may need special image formats. Make sure, they are noted down in your short protocol.
- ☐ Label any tubes or sample containers that can be labelled beforehand. In some cases, you can also print the labels and have them ready for your experiment.



1 – 2 days before your experiment

Check one last time

- ☐ that everything is ready and in place.
- ☐ Are all your reserved items still there?
- ☐ Check your short protocol one last time.
- ☐ Make a last run-through of all the procedures.
- ☐ Make sure that you do not have any other tasks that might come up on the day of your experiment. Of course, some things are out of your control, but whatever is in your hands, make sure, it will not come in your way right before or even during your experiment.



DAY 0

THE DAY OF YOUR EXPERIMENT

- ☐ Start your day well-rested, and be on time for your experiment

During your experiment

- ☐ Note down from the beginning
  - Any deviations from your protocols.
  - Also note down how long each section of your protocol actually takes.
  - Take pictures wherever possible and necessary. Make sure, they are of good quality, that they have a high resolution, that there is enough light, and that the pictures are on focus. Nothing is more annoying than having pictures that cannot be used for a publication, because of poor quality.
  - Label tubes etc. correctly, or use the printed labels that you already prepared.

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After your experiment

- ☐ Return things where they belong.
- ☐ Clean up everything.
- ☐ Switch off everything.
- ☐ Save pictures etc. immediately at the right place (meaning the files, you already prepared).
- ☐ Complement your protocols. Now. Do not keep that for later.
- ☐ If anything went wrong, now is the right time to analyse what went wrong and to check if it was
  - unavoidable
  - prone to happen
  - or just bad luck.

Figure out, what you can do to prevent this from happening again!
And if there was anything that did not work out the best way possible, try to analyse what happened, and what you could do to improve this setting or condition.

If everything went well, enjoy the moment! This means, your performance was excellent, and you are one step closer to the publication of your meaningful data. You also contributed to our incredible tradition of scientific knowledge acquisition.