INSTITUTE FOR RESEARCH IN BIOMEDICINE

IRB BARCELONA

IMPLEMENTATION OF SUSTAINABLE BEST PRACTICES IN LABS:

Sustainability begins with an awareness of the impact of our actions.

It is possible to reduce the environmental impact of laboratories without compromising the integrity of research.

MEASURES THAT CAN BE DIRECTLY IMPLEMENTED IN LABS:

- Recycle the capsules of the current coffee machine. In administration, a container for these capsules has been placed next to the coffee machine and staff members volunteer to take them to the Nespresso store.
- Switch to recycled and unbleached paper (this paper is available in the purchase portal). Use white paper only when necessary.
- Ensure that all employees have the default double-sided black and white printing option on their computers.
- Use your own cup/glass or single-use paper cups and plates for celebrations.
- Put up some sort of awareness material (poster) in the photocopier area that sets out good environmental practices.
- Reduce the use of plastic bags, have only one bin for plastic, and another for paper.
- Save bubble wrap, envelopes, and boxes for reuse in shipments that the group has to make.
- Put a notice near the printer about the price of each page printed. The cost varies according to the printer model, but is approximately €0.0063 per page in black and white and € 0.042 per page for colour printing.
- Avoid phantom consumption: connect mobile chargers, coffee makers, computers and printers, etc, to power strips with a switch and disconnect the power strip if you are the last person to leave the lab and turn it on again in the morning.

WASTE

Labs produce a lot of waste. Biological research accounts for an estimated 1.8% of total global plastic consumption. It is estimated that every year the plastic waste from laboratories alone would cover an area 23x the size of Manhattan ankle-deep. Although much of this waste is hazardous, a lot of it is not. In fact, anything that can be thrown in the trash has the potential to have a different end of life.

REDUCE: The best way to tackle waste is to reduce its production from the start. Here are some tips to reduce laboratory contribution to landfill:

- Once upon a time scientists used glassware instead of plasticware. Consider using glass whenever possible.
- Consolidate orders and order only what you need (bulk purchases are only a good deal if you need that much). If you only need a small amount, consider asking for a sample instead.

- Share resources. If you have something you aren't using, offer it to your colleagues. This includes equipment, reagents/chemicals, and consumables. The organisation can set up a system through which to inform them what you have available and what you need (extra chemicals, consumables, equipment etc).
- Purchase from vendors that take measures to reduce packaging or that use recycled packaging. Many vendors have made concerted efforts to use smaller boxes and less (or no) styrofoam in their packaging. For example, Thermo has recently released a cardboard box alternative to their EPS coolers.
- Purchase items that have long lifetimes, or that eliminate waste streams. For example, a waste stream of mercury bulbs can be eliminated by purchasing solid-state lighting instead; the waste stream associated with photo processing (the developer, the film, etc) can be eliminated by using a digital system.

REUSE:

- Use reusable batteries.

Any plastic that is not characterised as a biohazard or radioactive hazard can potentially be recycled.

MANAGE INVENTORY: Good stock management practices can lead to significant cost savings for the lab (avoiding duplicate purchases), and can considerably reduce the amount of waste produced (fewer out-of-date bottles discarded).

ENERGY

Labs are one of the largest energy-consuming sectors in the country. After data centres, labs are widely recognised as consuming more energy per square foot than any other sector due to their energy-intensive equipment, around-the-clock operations, 100% outside air requirements, and high airflow rates.
Ultra-low temperature freezers can use as much energy as an average household every day.

- Small water baths can consume as much energy as a dishwasher every hour; large water baths can consume as much energy as a window air conditioner every hour.
- Even heat blocks can use as much energy as a 50" TV.

BE GOOD IN THE HOOD: A single chemical fume hood can use as much energy as 3.5 households every day due to the large volume of air that must be moved through the hood by the ventilation system.

Airflow volume in a fume hood is manipulated by adjusting the height of a movable sash, which acts as a barrier between the inside of the hood and the rest of the lab. The sash should be raised when working in the hood, and in most cases the sash should be lowered when work in the hood is complete to ensure the safety of lab personnel. In a VAV fume hood, lowering the sash also reduces the speed of the exhaust fan and the volume of air being expelled by the VAV ventilation system. The energy savings from lowering the sash in a VAV fume hood can be upwards of 40%.

To raise awareness about safety and sustainability for fume hoods, you can put stickers on the sashes reminding users to close them.

OPEN THE FREEZERS AS LITTLE AS POSSIBLE: Each time they are opened energy consumption increases.

Consider adjusting setting points on -80ºC freezers to -70ºC. This measure can reduce energy consumption by 30-40% and increase the machine lifespan. However, is it safe to store my samples at -70ºC? In most cases, the answer is a resounding YES. Nucleic acids can be safely stored at -20ºC, or -70ºC, depending on how long they need to be stored, and most proteins can be safely stored at -70ºC. Bacteria and viruses are also generally safe at -70ºC. In fact, fifteen years ago *all* ultra-low freezers were set to -65ºC or -70ºC. Click below for evidence that -70ºC is a Safe Temperature to Store Samples: https://www.mygreenlab.org/-70-is-the-new--80.html

ELIMINATE UNNEEDED SAMPLES FROM THE FREEZERS

MERCURY-FREE MICROSCOPY: Light engines, LEDs, and solid-state devices are all better choices than mercury and metal halide light sources for microscopes. Not only do they not contain mercury, they also use significantly less energy (consider the amount of heat put out by a mercury bulb; most solid-state devices run at room temperature). Moreover, these light sources are more stable over time, allowing quantitative measurements to be made reliably.

DON'T USE SCREENSAVERS: Running screensavers requires the use of computer processing power and memory, and as a result uses energy. Turn off computers and monitors completely when not in use.

TURN OFF EQUIPMENT: Chilled centrifuges, ovens, and heating blocks all require a certain temperature to be maintained. Maintaining a set temperature, whether hot or cold, requires a lot of energy. Turning off these types of equipment when they are not in use can save a significant amount of energy, up to 10 kWh/day. A home refrigerator uses about 5 kWh/day, so turning off your chilled centrifuges and ovens can be like turning off two refrigerators in terms of energy savings. Heating blocks left on at high temperatures also pose a risk to anyone working in the lab and should never be left on.

TURN OFF LIGHTS: Remember to turn off lights in the main lab and support rooms, such as microscope, cold/warm, and tissue culture rooms when you leave. You may also consider turning off the lights when daylight is adequate. There is a common misconception that it is better to leave lights on all the time rather than turn them on/off in quick succession.

SHUT DOWN BIOSAFETY CABINETS (BSCs): Turn off biosafety cabinets when not in use. BSCs can consume 15 kWh/day - about half as much as a house. If you're working in a BSC with a UV light, note that UV sterilizers need only be on for 30 minutes at most in tissue culture hoods. Leaving them on for longer can lead to the breakdown of any plastics in the hood, as well as affect people working in the area. Many recent models of hoods have timers on them to ensure that the UV light is turned off after 30 minutes.

WATER

Labs can use a lot of water: cage washers, autoclaves, DI water, and single-pass cooling etc.

- It takes 11.35 litres of water to make 3.78 litres of deionized (DI) water (that is at least 11.35 of water for every gel you run).
- Single-pass cooling systems can easily lead to 1 lab using more than 49,200 litres of water each year.
- Autoclaves can use as much as 227 litres of water per cycle. And if your autoclave is >10 years old, chances are it uses up to 350 litres per cycle.

What can be done to reduce water in the lab?

BE SMART WTIH AUTOCLAVES:

- Consolidate loads. Don't run an autoclave to sterilize a single box of pipette tips.
- Right-size your autoclave. If you don't need a large autoclave, use a smaller one instead.
- Consider energy- and water-efficiency when purchasing autoclaves.

ELIMINATE SINGLE-PASS COOLING: Single-pass cooling is the term used to describe a process that uses water to cool something once. This is in contrast to closed-loop or recirculating systems, which reuse water continuously. Single-pass cooling can be found in equipment such as autoclaves and ice makers, or to cool down reactions.

Single-pass cooling is not only wasteful but, as many labs know, can be a safety hazard as well. Eliminating this from your workflow can save hundreds of thousands of litres of water each year and prevent the risk of flooding.

BE EFFICIENT: Establish efficient labware washing practices. Run dishwashers, autoclaves, and cage washers only when they are full, and turn off these pieces of equipment or put them into standby mode when you are done using them.

DISTILLED WATER: Distilled water should be used only when it is required for experiments, and not regularly as a substitute for tap water. The process of making distilled water is highly inefficient, with nearly 3 litres of water required to make 1 litre.