Scientific Brief

How Ergonomics and Cleaning Ease Reduce Repetitive Stress Injuries and Contamination in Pharmaceutical Lab Workflows

Introduction

The repetitive nature of routine laboratory work puts pharmaceutical technicians and scientists at risk for repetitive strain injuries (RSI). Routine activities often include repeat of the same movements over and over, which can take a toll on hands, wrists, and shoulders and can lead to serious injury. According to the Occupational Safety and Health Administration (OSHA), RSI in the workplace resulted in over 300,000 cases as far back as 2015.[1]

RSI is closely related to ergonomics of instrument operation when conducting simple but repetitive laboratory processes. According to an article on common laboratory worker disorders by certified ergonomist Kevin Costello, musculo-skeletal movements involving repetition, contact stress, force, and awkward posture present the most risk for injury.[2]

RSI can lead to laboratory user fatigue and variability that causes poor technique, errors, and cross contamination. The result is retesting that can add up to 14 days for procedures such as sterility testing. In addition, the societal costs of carpal tunnel syndrome, a key result of RSI, has been estimated at $30,000 per case. This figure does not include indirect costs, such as lost productivity and quality of life issues that extend to everyday activities.[3]

Microbial cross contamination also can result when laboratory filtration devices such as manifolds, filter funnels, and pumps are difficult to clean.

This paper explores new filtration designs that are considerably more ergonomic and easier to clean than conventional products.

Reducing RSI: The Secret Is In Product Design

In a pharmaceutical microbiology laboratory, there are many ways to avoid manual labor stress by working in a more ergonomic manner. Choosing the right tools can make all the difference. Pre-sterilized filter funnels are a more efficient option for microbial contamination and quality-control testing, with the funnel and membrane in a ready-to-use, disposable system. The membrane is contained within the funnel for filtration, limiting handling and transfer, which reduces repetitive laboratory motions.

On most of these disposable devices the funnel top is removed by twisting or other motions that can put stress on wrists and arms. Additionally, twisting the top of the funnel can often tear the delicate membranes beneath, resulting in the need for retesting. When using an alternative such as the Pall MicroFunnel™ filter funnel, the top is removed with a simple squeeze of its sides. Then, the user can easily access the membrane.

Another step forward in reducing RSI is a better-designed manifold, such as the Pall Laboratory Manifold.

The Pall Laboratory Manifold has few parts, no required tools, and simple friction fittings for easy disassembly and reassembly. This simplified design can save precious time and reduce RSI risk.

Additionally, since the device's end cap and hose barb can be setup in either orientation, all the valves are situated at the front of the manifold. This means there is no need to reach over the top of a filter funnel and maneuver behind a manifold to turn the valves on and off. Both features improve contamination prevention and reduce injury risk.

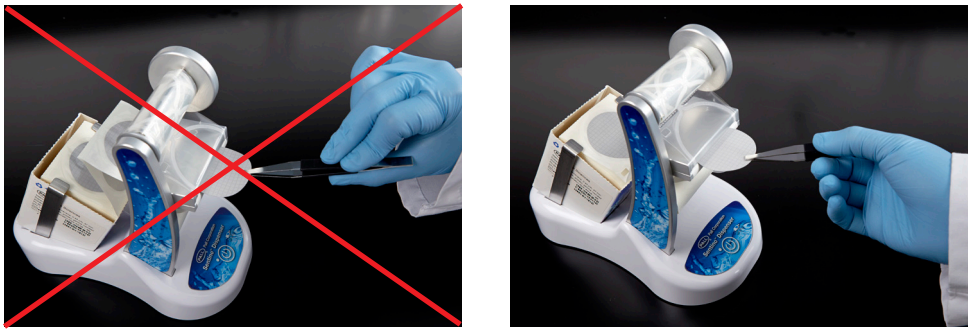
Finally, the Pall Laboratory Manifold enables processing of up to six samples at one time when two manifolds are connected together with a coupling device. Over time, this design can mean less handling and lower risk of RSI.

Reducing RSI: Improving Laboratory Techniques

RSI can be further reduced when technicians are well-trained in techniques such as the use of forceps and membrane handling. Proper orientation and handling of forceps is not only important to the technician's health, but also crucial for good microbial growth.

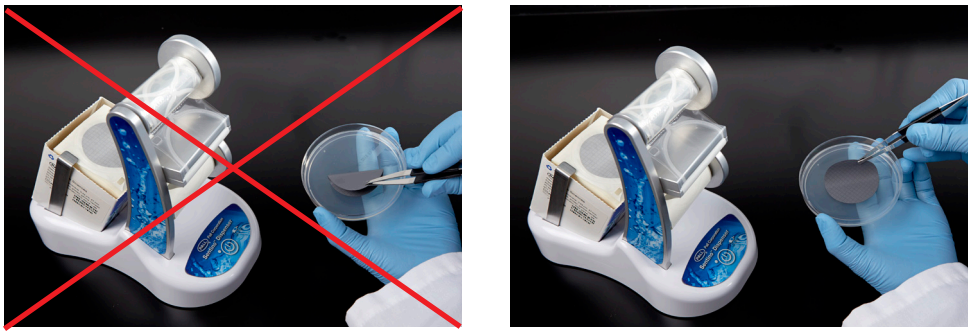
In the figures below, you can see in the left image that the hand is in an awkward position. This can cause pain during membrane removal. In the right image, the forceps are held properly, giving the hand more freedom and a more natural and comfortable feel.

Figure 1



In figure 2, the plating technique in the left image is not only awkward, but also increases the risk of creating bubbles on the bottom of the filter membrane. Air bubbles are a concern because when the agar media does not properly touch the membrane, nutrients do not reach the membrane as expected. This can cause improper cell growth that can result in false negatives. Proper technique is demonstrated in the image on the right.

Figure 2



Cleanliness: The Key to Eliminating Cross Contamination

The cleanliness of your laboratory equipment is the key to eliminating cross contamination and the resulting delays caused by retesting. Employing manifolds, pumps and funnels with easy-to-clean or disposable designs will result in contamination-free devices - a welcome advantage when cleaning is required at least once daily in high-throughput labs.

Laboratory manifolds offer microbes welcome places to hide. Look for stainless steel devices with few pieces to disassemble and assemble such as the Pall Laboratory Manifold. Their fluid paths should be free of O-rings, plus lowered hose outlets will eliminate the back-burping that can require expensive and time-consuming retesting. Make sure the manifold is designed to easily fit in laboratory autoclaves by separating into manageable components.

When purchasing a new microbiology pump, such as Pall's Sentino® pump, make sure it has a disposable fluid path that requires no cleaning or disinfection. A disposable pump fluid path, combined with a gamma-irradiated filter funnel option, virtually eliminates the risk of cross contamination from test equipment.

Disposable filter funnels, such as the Pall MicroFunnel ST filter funnels, not only eliminate cross-contamination that can come from reusable funnels, but also have a second overpack layer that streamlines cleanroom or hood entry, with one wipe down for multiple individually-packed funnels. This overpack layer reduces gross particulate contamination that can come from cardboard.

Conclusion

RSI and ease of cleaning are often overlooked when choosing the microbiology filtration solution to best suit your pharmaceutical laboratory needs. It is important to select high-performance products with ergonomics that reduce long-term injury risk. The goal is to eliminate the user fatigue and variability that can lead to poor technique, errors, and retesting. Reducing microbial cross-contamination and subsequent retesting will save the laboratory time, resources, and product development delays.

References

1 https://www.bls.gov/news.release/osh2.nr0.htm

2 Repetitive Strain Injury in the Laboratory, VistaLab Technologies, August 25, 2020.

3 Repetitive Strain Injury in the Laboratory, Biocompare, March 29, 2018.

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