

A clean start

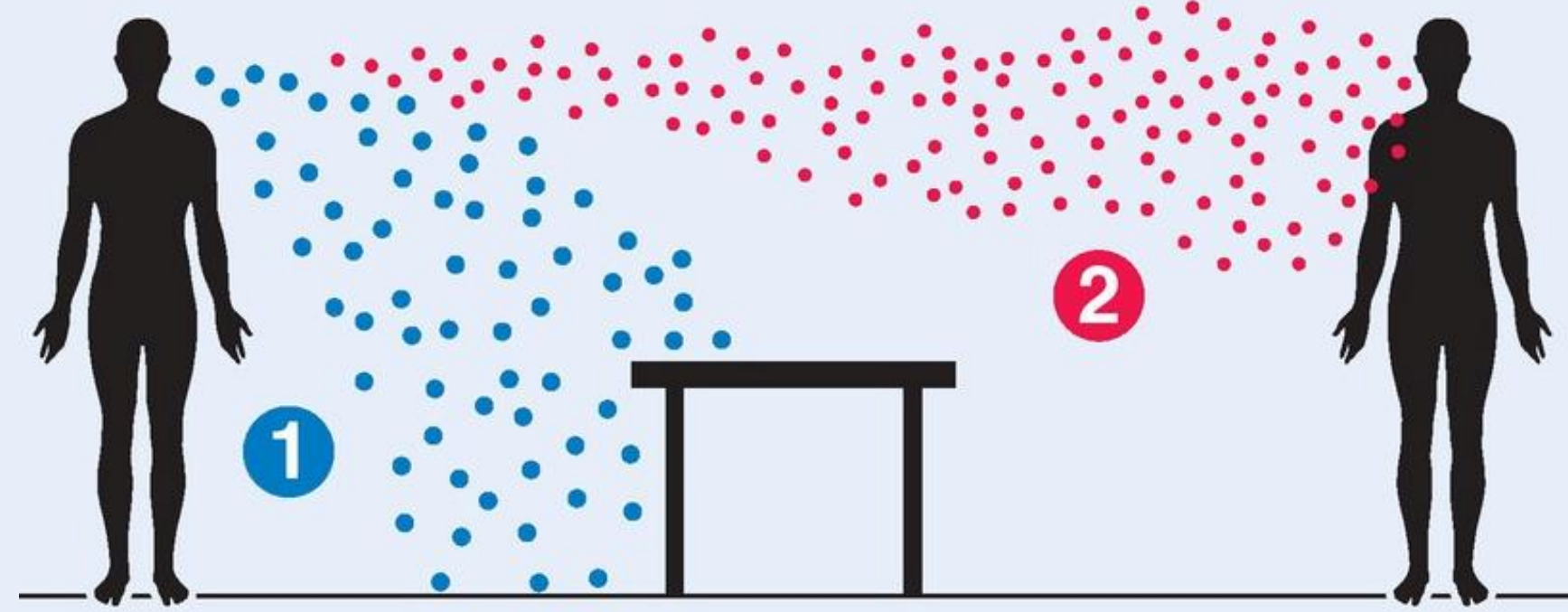
Microbiological quality of surfaces and efficiency of disinfectants

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Introduction

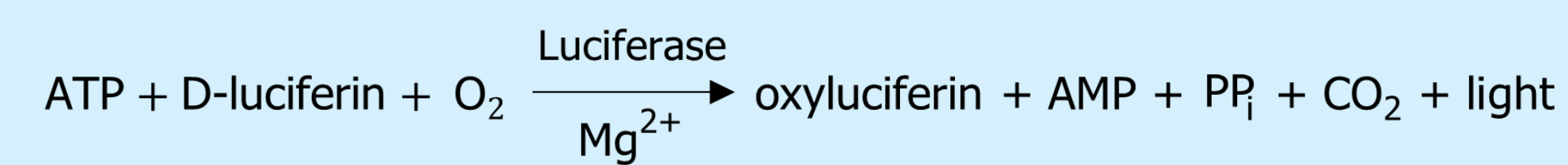
- Investigation of the microbiological quality of surfaces, objects and hands.



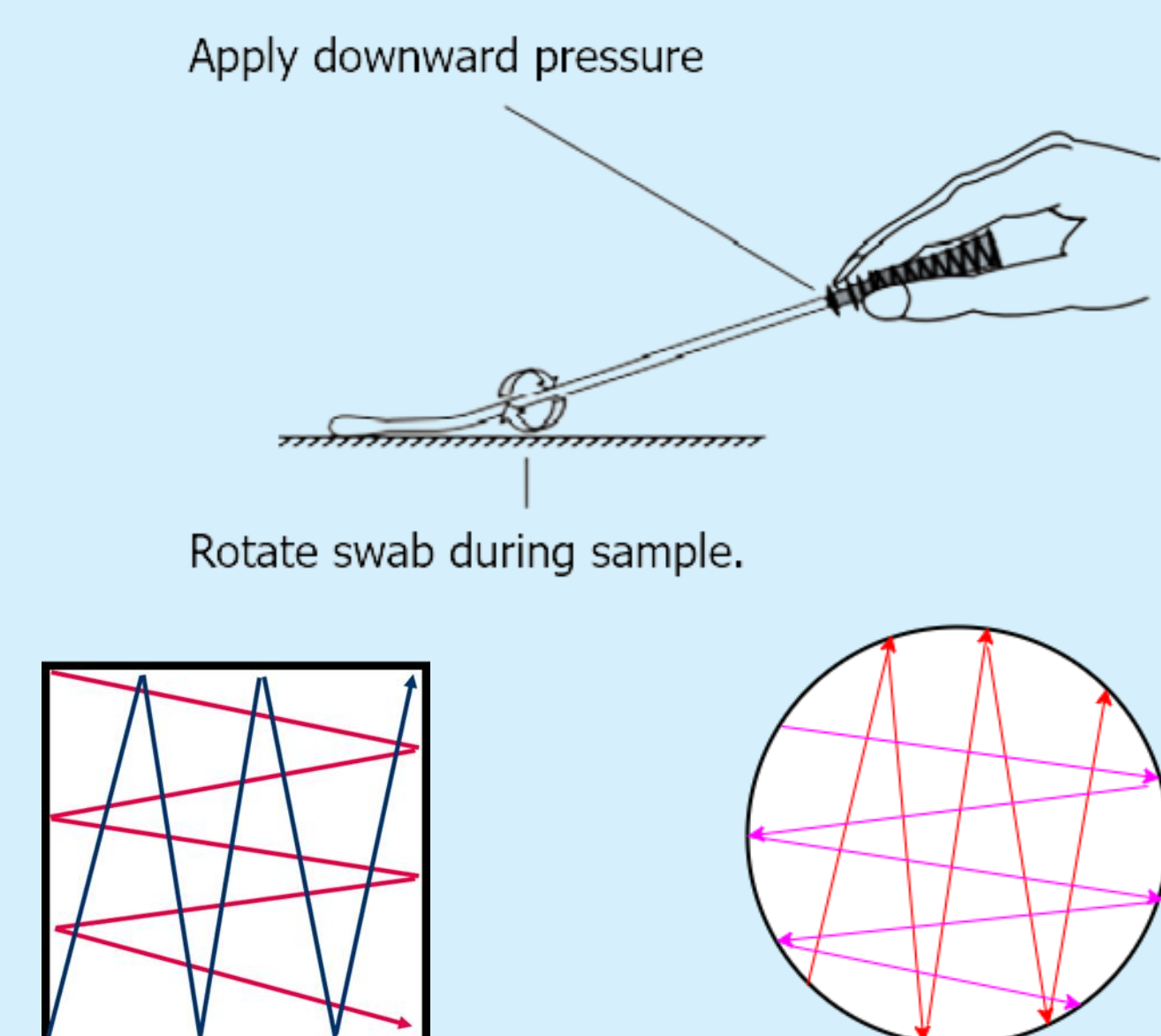
- Obtaining a dry contaminated surface by means of a nebulizer, which imitates a cough or a sneeze.

The ATP bioluminescence meter

- The 3M™ Clean-Trace™ Luminometer measures the amount of adenosine triphosphate (ATP) present on the surface and converts it in bioluminescence signal. This light reaction is caused by the oxidation of luciferin in presence of luciferase and ATP. The light measured is expressed in Relative Light Units or RLUs (1, 2).



- ATP is an ideal indicator for biological contamination, seeing as it is a metabolite that is present in all living cells and plays an essential role in cell growth (3).
- The corresponding swabs (3M™ Clean-Trace™ ATP Tests) were used in a consistent manner.



Validation

ATP bioluminescence meter

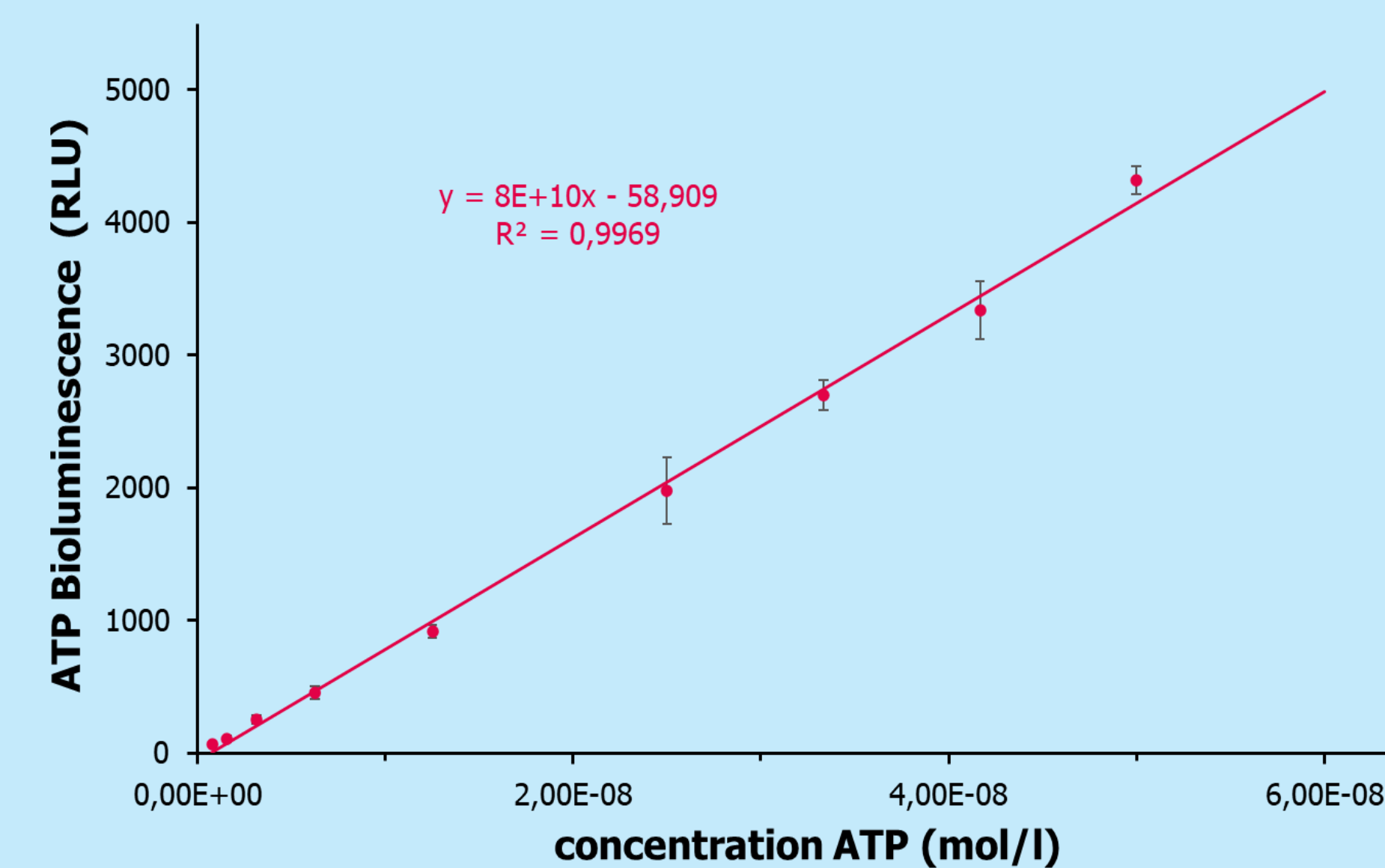


Figure 1: Graphical representation of the ATP bioluminescence (RLU) of the ATP dilution series in Milli-Q water.

Growth experiment

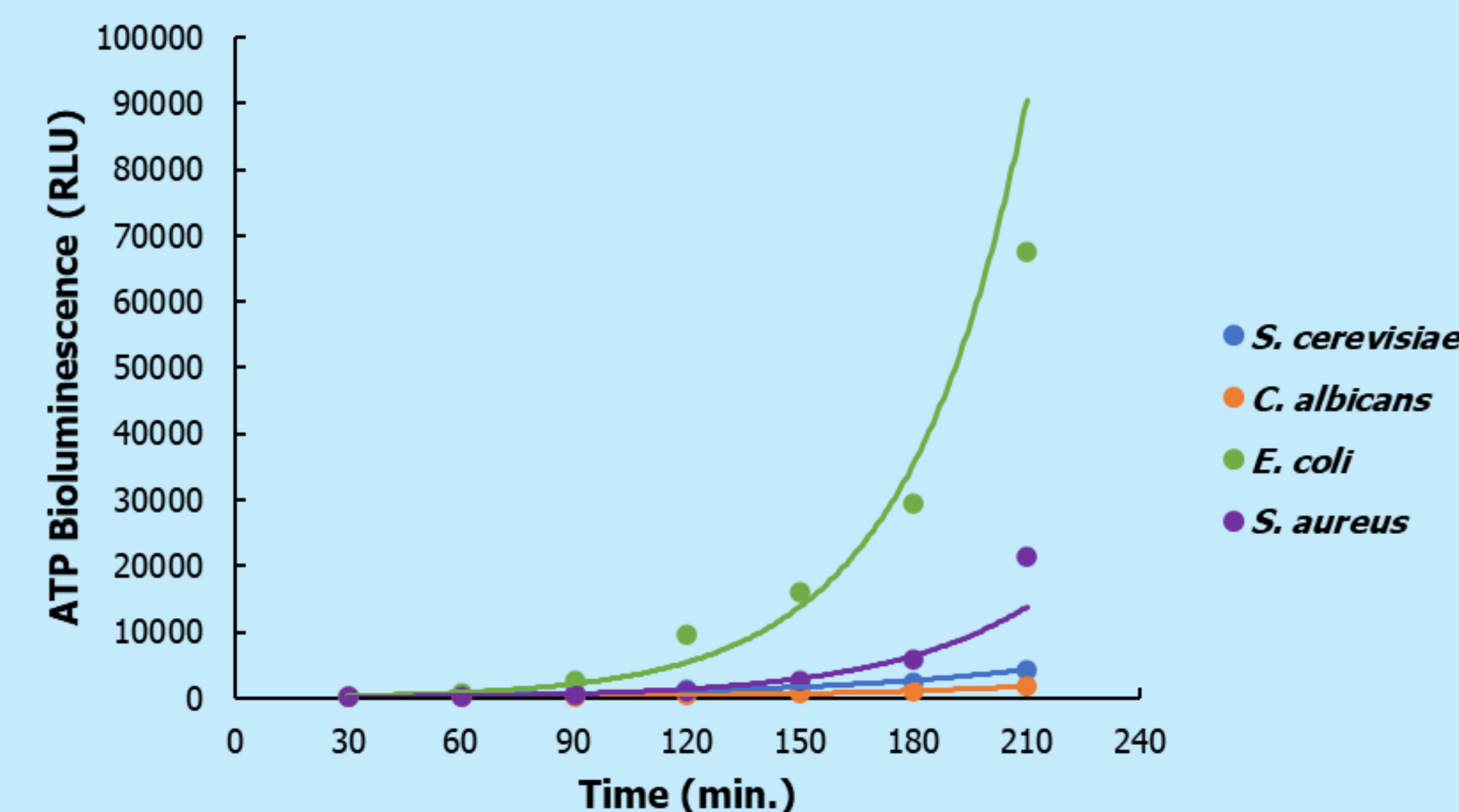


Figure 2: Graphical representation of the ATP bioluminescence measurements over time.

Nebulization

- Simulation of a coughing pattern with a nebulizer

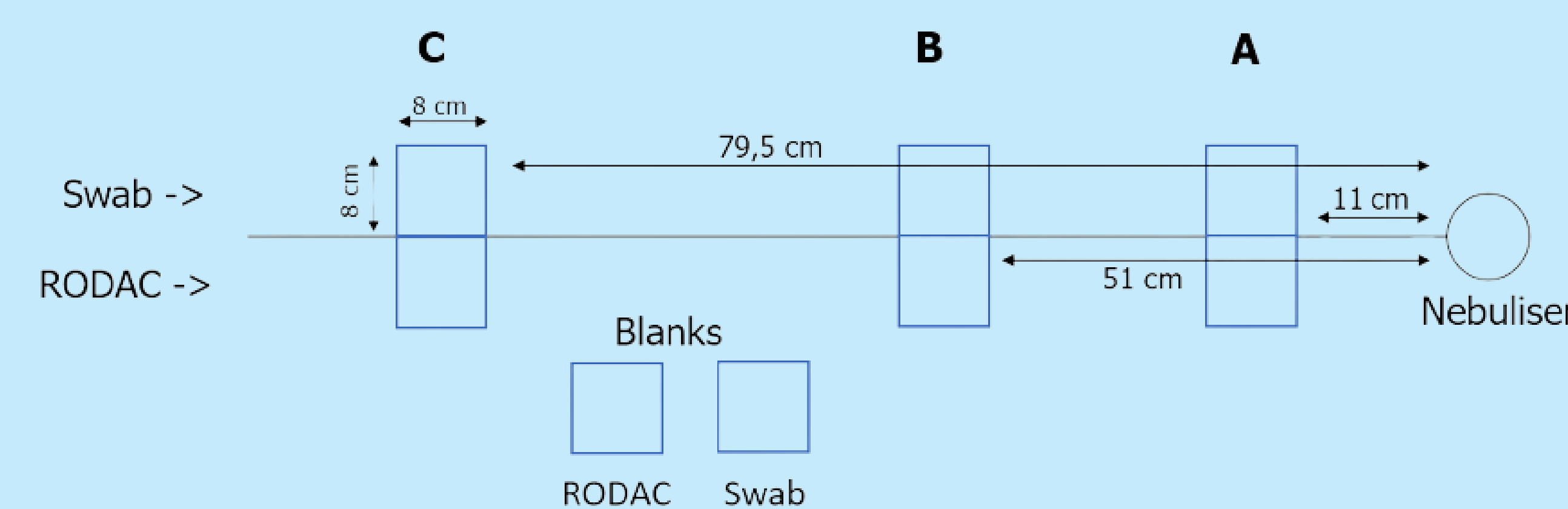


Figure 3: Setup of the nebulizer.

- The surface directly below the nebulizer (person) is less microbially contaminated than the surface in front of the person.

Microbiological contamination of surfaces

- Evaluated environments: computer mice, bathroom door handles and payment methods (green, orange and blue).

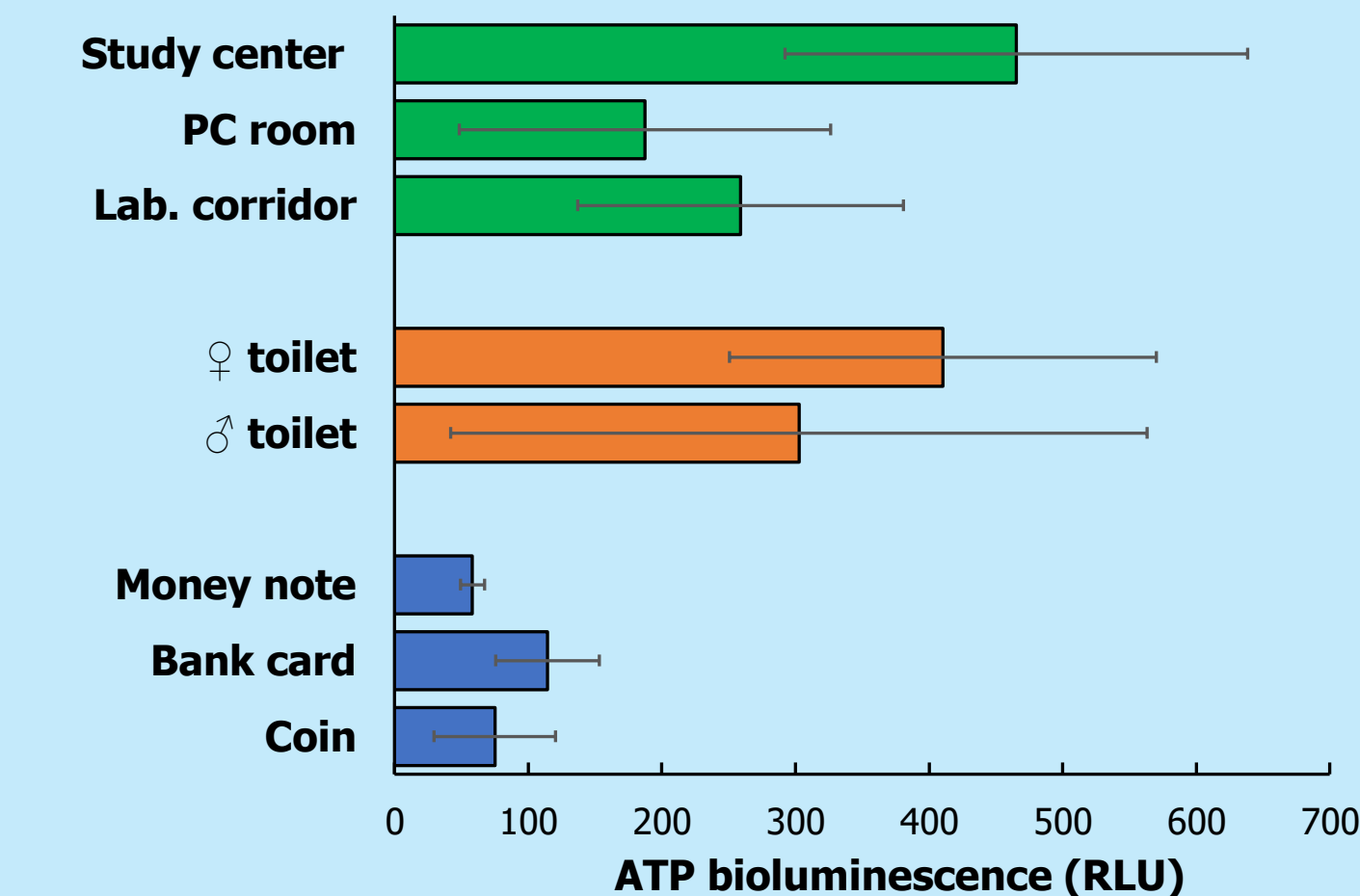


Figure 4: Graphical representation of the ATP bioluminescence measurements of the surfaces.

- Washing hands and drying with either an air dryer or a cloth roll (blue and orange)

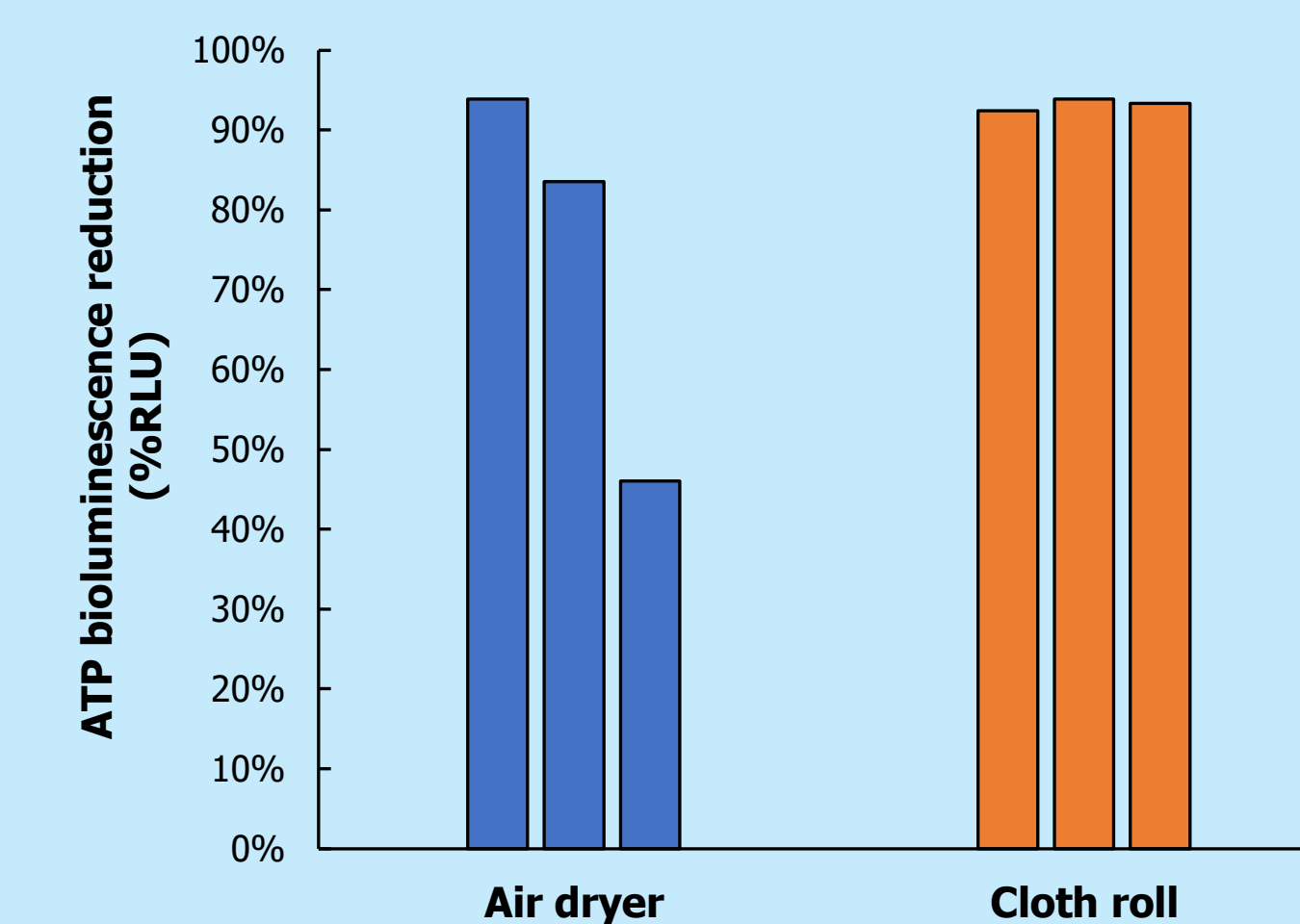


Figure 5: Graphical representation of the ATP bioluminescence reduction in %RLU.

Conclusion

- The ATP bioluminescence meter can be used to estimate the amount of micro-organisms on a surface.
- The signal has a linear correlation with the concentration of ATP.
- The ATP meter measures growth sooner than the spectrophotometer.
- The bank card is the least clean payment method.
- The cleanliness of the toilet doorhandle depends on the stall and not the gender of the bathroom.
- The computer mice in the study centre are the dirtiest.
- Drying your hands with a hand dryer after washing them may introduce new bacteria on your hands.
- A dry contaminated surface can be replicated via the use of a nebulizer.

1. ATP, RLUs and CFUs 2010 [05/12/2022]. Available from: <https://multimedia.3m.com/mws/media/6867530/clean-trace-atp-rlu-and-cfus.pdf>.
2. Lee J. Bioluminescence: the First 3000 Years (Review). Journal of Siberian Federal University. 2008;1:194-205.
3. Lin W-H, Jacobs-Wagner C. Connecting single-cell ATP dynamics to overflow metabolism, cell growth, and the cell cycle in *Escherichia coli*. Current Biology. 2022;32(18):3911-24.