

BIO 2134 Tutorial (Accuracy and Precision)

1. Imagine you are conducting a protein quantification experiment using a spectrophotometer. If your measurements are consistently close to each other but differ significantly from the known concentration of the protein, would you say your results are more accurate or more precise? Explain why and discuss how you would improve the situation.

If the measurements are consistently close to each other but differ significantly from the known concentration, the results are precise but not accurate. Precision refers to how close the measurements are to each other, while accuracy refers to how close they are to the true value. To improve accuracy, one might need to recalibrate the instrument, check for systematic errors, or improve the experimental design to minimize biases that are affecting the accuracy.

2. In a clinical laboratory, different technicians perform the same assay on identical samples but obtain slightly different results. Discuss whether this scenario highlights an issue of accuracy or precision and suggest possible reasons for the discrepancies.

This scenario highlights an issue of **precision**, as the results differ between technicians even though the samples are identical. The variation suggests a lack of consistency in the measurements. Possible reasons for the discrepancies could include differences in technique, slight variations in instrument calibration, or inconsistencies in environmental conditions (e.g., temperature or humidity). Standardizing procedures and regular calibration of equipment could improve precision.

3. You are testing a new diagnostic method that produces results which are consistently 10% higher than the known values, even though repeated measurements of the same sample yield nearly identical results.
 - (i) How would you categorize the method's accuracy and precision? Explain why.
 - (ii) What steps would you take to address the issue?

The method demonstrates **high precision** (because the repeated measurements are nearly identical), but **low accuracy** (because the results are consistently 10% higher than the true values). The issue is likely due to a **systematic error** in the method. To address this, one would need to investigate the calibration of the instruments, the reagents used, or the experimental setup to identify and correct the source of the systematic bias.

4. A biotechnology company is evaluating the performance of two different analytical methods for detecting a biomarker in blood samples.

Method A consistently produces results close to the true biomarker concentration but varies significantly between trials.

Method B gives highly consistent results but is often far from the true value.

- (i) Which method is more accurate?
- (ii) Which is more precise?