Introduction – systematic vs. random errors

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September 10, 2009

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- Often it is only a quantitative result that has any value at all. *for example, almost all samples of (human) blood serum contain albumin; the only question is, how much?*
- Even where a qualitative answer is required, quantitative methods are used to obtain it. *Quantitative approaches might be used to compare two soil samples. For example, they might be subjected to a particle size analysis, in which the proportions of the soil particles falling within a number, say 10, of particle-size ranges are determined. Each sample would then be characterized by these 10 pieces of data, which could then be used to provide a quantitative assessment of their similarity.*

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- A knowledge of the experimental errors is crucial.

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- All four values are different, because of the variations inherent in the measurements
- The fourth value (25.39 ml) is substantially different from the other three.
- Can it be safely rejected, so that (for example) the mean titre is reported as 24.73 ml, the average of the other three readings?

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- Each student performs five replicate titrations, with the results shown in Table 1.1.

Table 1.1 Random and systematic errors

Student	Results (ml)					Comment
A	10.08	10.11	10.09	10.10	10.12	Precise, biased
B	9.88	10.14	10.02	9.80	10.21	Imprecise, unbiased
C	10.19	9.79	9.69	10.05	9.78	Imprecise, biased
D	10.04	9.98	10.02	9.97	10.04	Precise, unbiased

Graphical illustration

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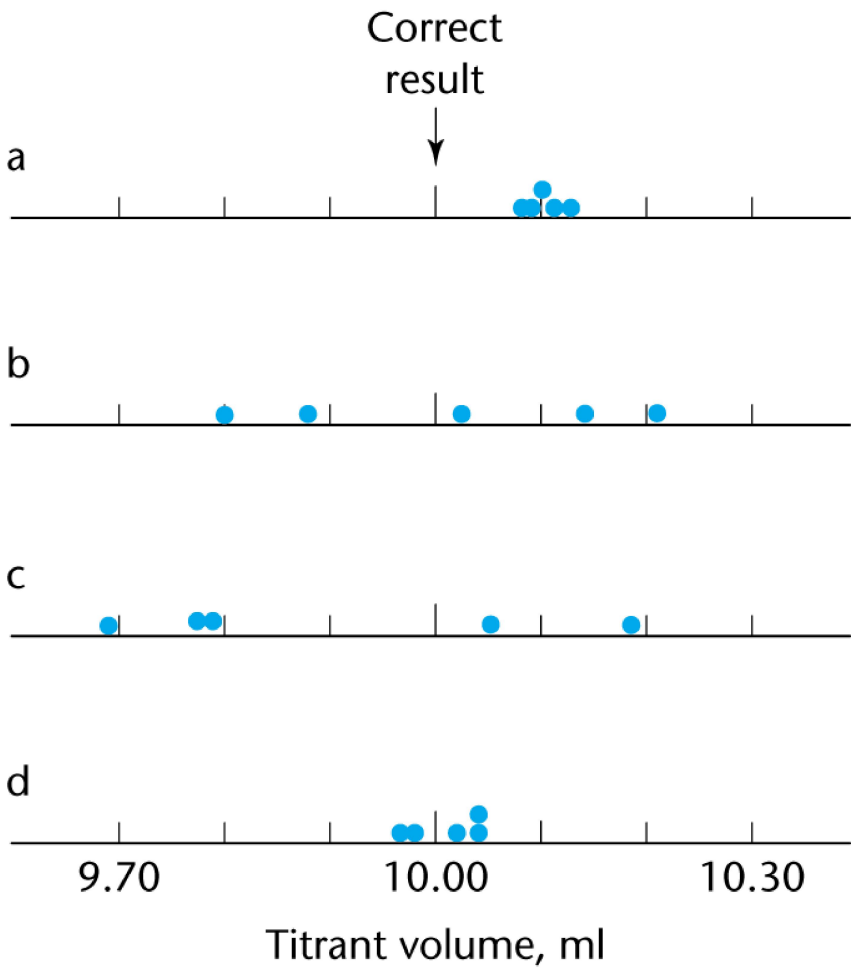
The results of experiment represented by dotplots



The true value is 10.00

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- This value is often called precision of measurements.

Combined error vs. accuracy

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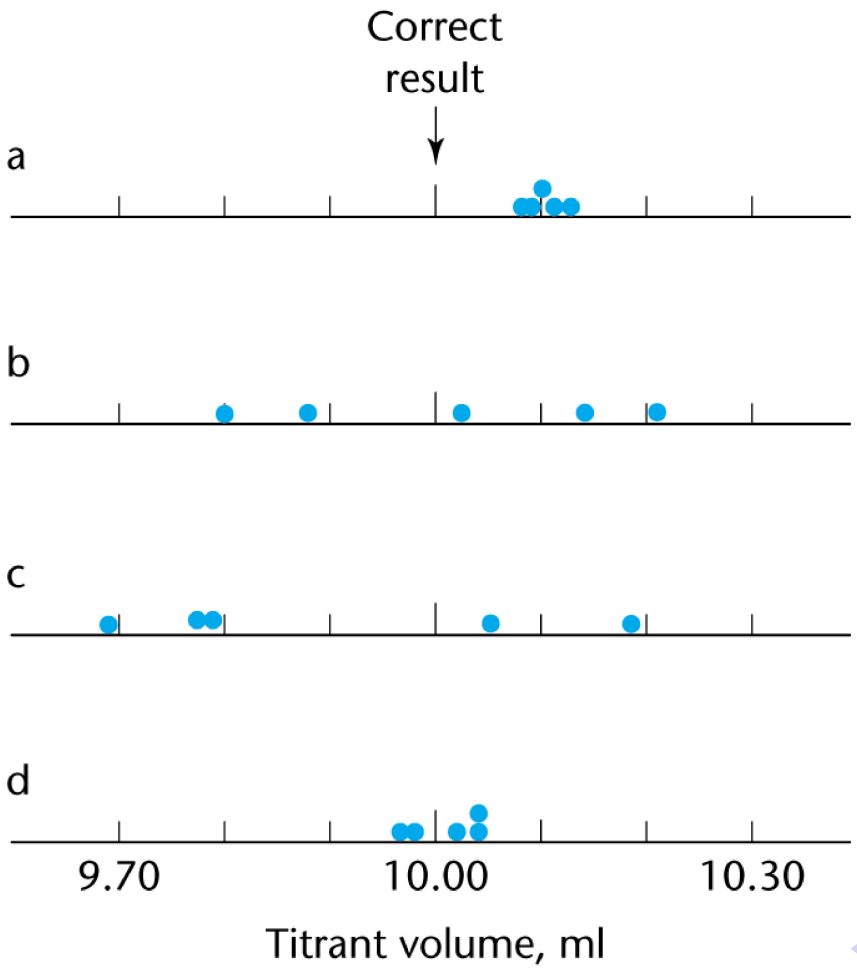
- Accuracy is in inverse relation to the total deviation of a single measurement from the true value.



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- If you did not notice - it is just a joke!