The Principles of External Quality Assurance

IFCC Committee on Analytical Quality

International Federation of Clinical Chemistry and Laboratory Medicine

What is Quality Assurance?

= external quality assurance (EQA)

= external quality assessment (EQA)

= proficiency testing scheme

System designed to objectively assess the quality of results obtained by laboratories, by means of an external agency.

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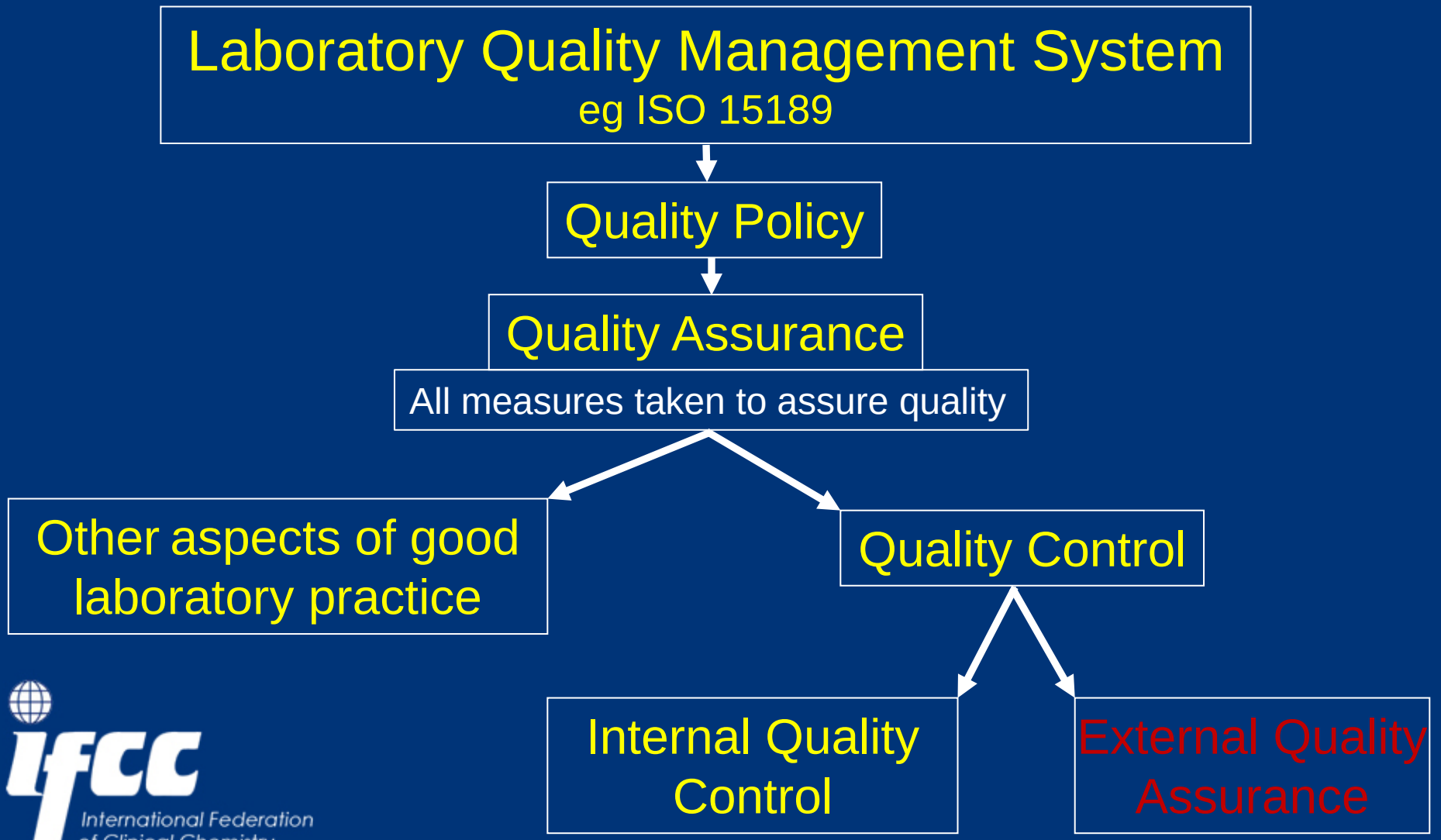
Monitoring the Quality of Lab Results



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Indicators of Laboratory Quality

- Internal quality control
- External quality assurance

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IQC vs EQA

	Internal Quality Control	External Quality Assurance
Results	Known	Unknown
Results Available	Immediately	Later, when report received
Frequency of Testing	Minimum daily, per batch, per shift	Periodically eg 1 / 4weeks 2 / 4 weeks 5 x 3 / year
Concentrations	Normal, abnormal	Multiple concentrations, eg 6-8
Assess	Imprecision	Accuracy & imprecision
Comparison	Your lab only	Your lab to all labs & other labs using your method

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ISO 15189: Medical Laboratories

- 5.6.4 The laboratory shall participate in organised interlaboratory comparisons, such as external quality assessment schemes, that encompass the extent and complexity of examination procedures used by the laboratory. The laboratory management shall monitor the results of external quality assessment and participate in the implementation of corrective actions when control criteria are not fulfilled. Interlaboratory comparison programs shall be in substantial agreement with ISO Guide 43.

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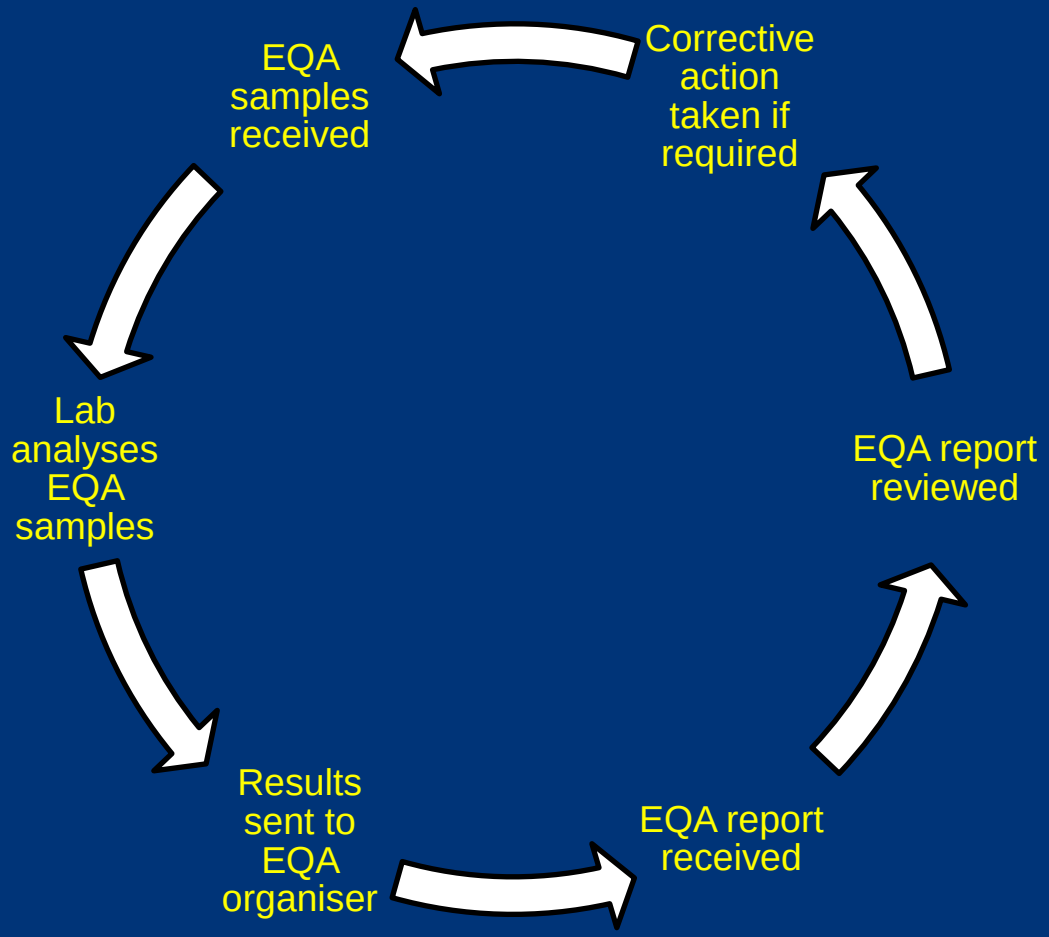
General Cycle of EQAS



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Objectives of EQA

- Provide a measure for individual laboratory quality
- To supplement internal quality control procedures
- Provide a measure of the “state of the art” for a test
- To obtain consensus values when true values are unknown
- To investigate factors in performance (methods, staff etc)
- To act as an educational stimulus to improvement in performance

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What to Look for in an EQA?

- ✓sample design & frequency
- ✓analytical goals
- ✓easy to read reports
- ✓scientific validity and reliability
- ✓education
- ✓scientific support

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Sample Design

- Appropriate matrix
- Stable, homogeneous material
- Appropriate concentration levels
- Appropriate frequency of testing

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Sample Matrix

- Frozen human serum
  - ideal
  - very expensive
  - difficult to obtain different concentration levels
  - unstable
  - storing and transport very expensive
  - danger of contamination

Sample Matrix

- Lyophilized human serum
  - more similar to patient specimens
  - good long term stability
  - very easy to transport
  - expensive
    - reconstitution errors
    - denaturation of proteins/lipoproteins
- Stabilized liquid serum
  - ready to use, easy to prepare
  - great matrix effects
  - less long term stability

Appropriate Concentration Levels

- Range of concentration levels
- Not just around the reference interval
- Cover the analytical range of methods

What to Look for in an EQA? Analytical Goals

1. Method classification system
2. Central value
3. Acceptable range

Method Classification System

- Should fully describe your method
  - analytical principle
  - instrument
  - reagent
  - calibrator / standardisation

YOUR DATA

Result (^) for 85-01 = **106** umol/L
Result (^) for 85-02 = **310** umol/L

Your Method Classification : **H 21L 021 S**

H	Alk.Picrate-rate-blk,compensate
21L	Roche Diagnostics Hitachi Modular
021	Roche Diagnostics (Hitachi)
S	Standardised against IDMS

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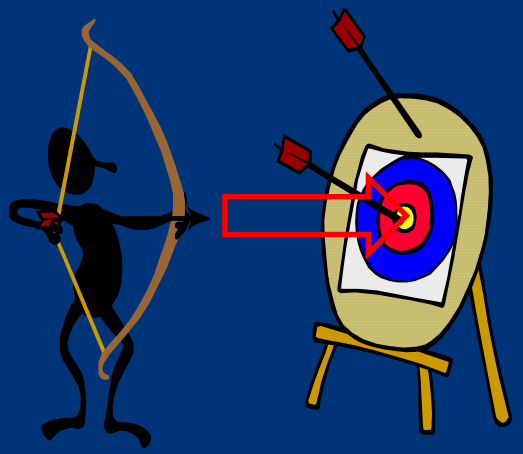
Analytical Goals
2. Central Value

- What is the ‘right’ value?
- What is the ‘true’ value?
- What is the ‘correct’ value?



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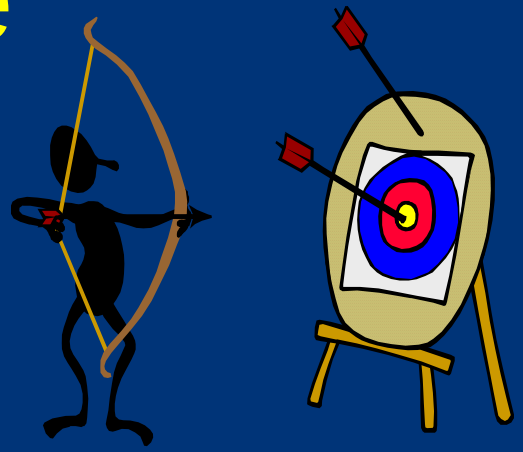
Analytical Goals
2. Central Value



- Target value
  - correct value
  - EQA material assayed by:
  - reference methods eg IFCC enzymes, HbA1c
  - reference laboratory
  - higher order methods eg mass spectrometry
  - secondary reference calibrators

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RCPAQAP Interim Report

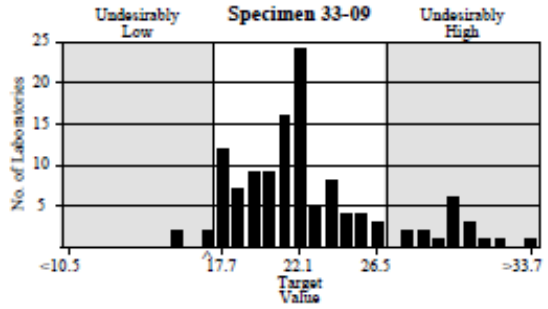
Printed
Feb 25 05:40:26 2011

Prepared by:
RCPA Chemical Pathology QAP Group

Due Date : 10/05/2010

Testosterone (nmol/L)

Laboratory Number



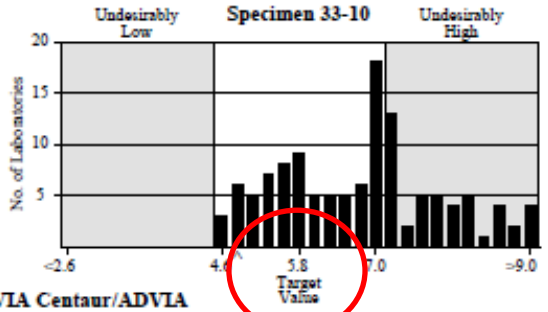
YOUR DATA

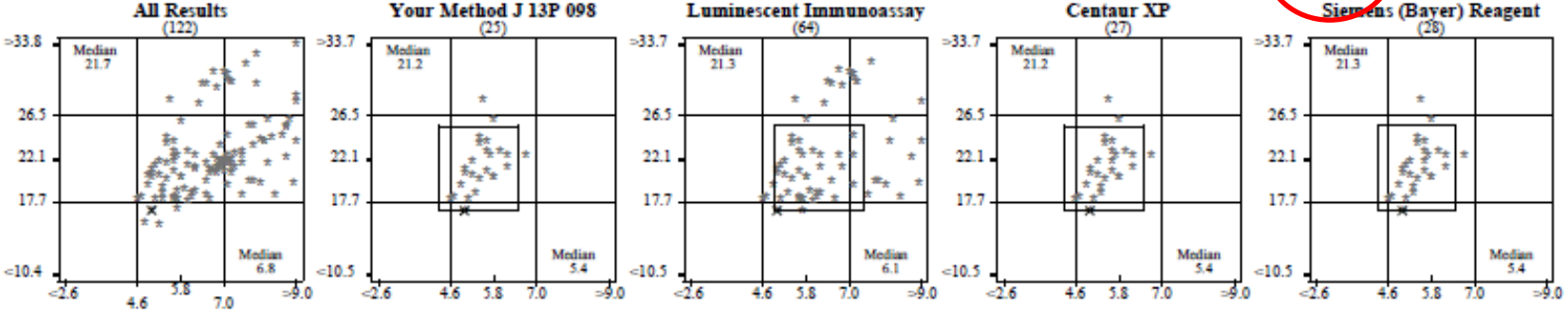
Result (^) for 33-09 = **16.9** nmol/L
Result (^) for 33-10 = **5.0** nmol/L

Your Method Classification : **J 13P 098**

J	Luminescent Immunoassay
13P	ADVIA Centaur/ADVIA Centaur XP
098	Siemens (Bayer)

Allowable Limits of Performance
±0.5 up to 2.5; ±20% >2.5 nmol/L

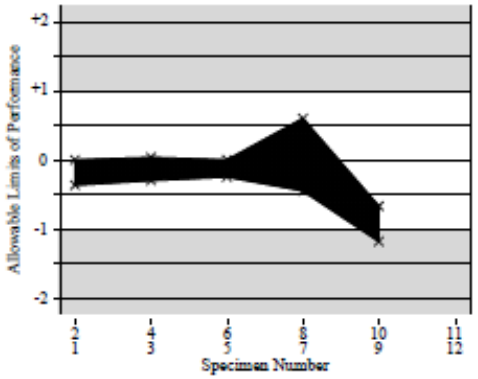


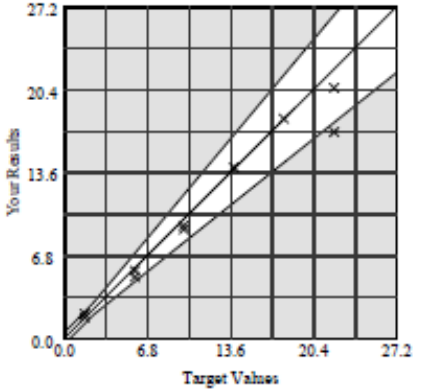


Current Data for Cycle 33

Spec.	Method	Target	Result	
33-01	J 13P 098	22.1	20.5	
33-02		1.7	1.7	
33-03	J 13P 098	9.8	9.2	
33-04		13.9	14.0	
33-05	J 13P 098	5.8	5.5	
33-06		18.0	18.0	
33-07	J 13P 098	9.8	8.9	
33-08		1.7	2.0	
33-09	J 13P 098	22.1	16.9	Low
33-10		5.8	5.0	
33-11				
33-12				

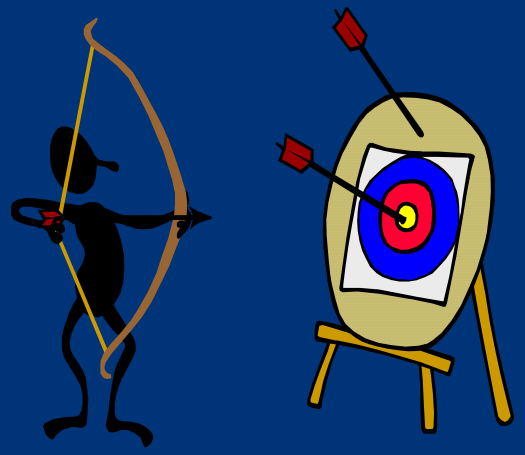
SUMMARY DATA





Endocrine Program

Analytical Goals
2. Central Value



- Statistical
  - overall mean, median
  - instrument mean
  - both show the ‘state of art’ but give no indication of the correct value

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BIO-RAD

Laboratories Number: 8000

Clinical Chemistry

24: Uric Acid

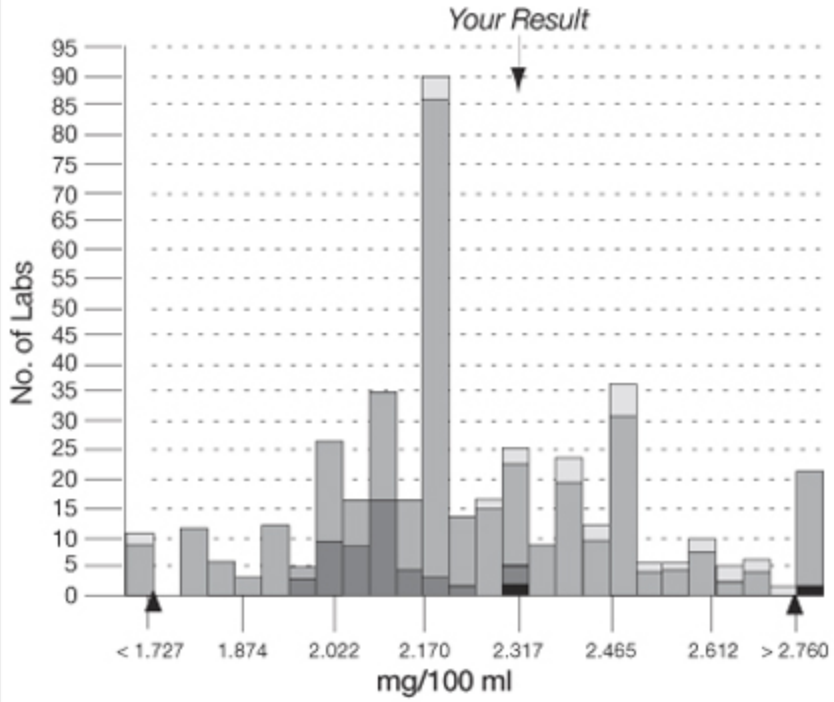
Sample Number: 5

Sample Date: 16/12/02

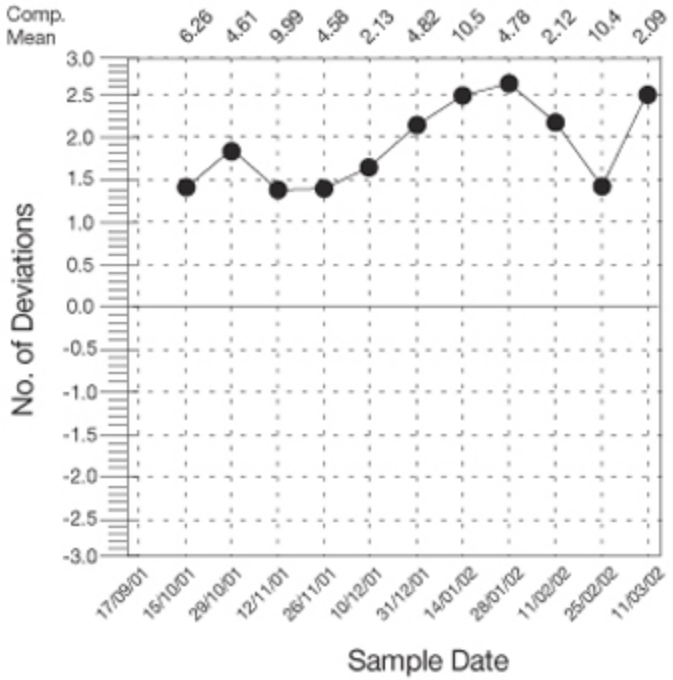
Your Result: 2.3 mg/100 ml

	Results Accepted	Mean	SD	Results excluded	Your deviation from mean SD's	Your deviation from mean %
All Results	413	2.24	0.258	6	+0.22	+2.5
Your Group	388	2.23	0.259	5	+0.26	+3.1
Your Method	49	2.09	0.085	1	+2.48	+10.0

Method : 712 – 462 – Uricase/perox colorimet Ortho Vitros



Levey-Jennings Chart : Uric Acid



Analytical Goals
3. Acceptable Range

- The analytical range around the central value
- A tool for review of EQA results
- It provides a simple tool to allow a rapid, standardised assessment of EQA results in both numerical and graphical report formats.
- A result outside the acceptable range should alert the laboratory that that their assay may produce results that are at risk of detrimentally affecting clinical decision making.

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Analytical Goals
3. Acceptable Range

- Can be based on
  - statistical comparison
  - regulatory requirements
  - clinical need
  - expert opinion
  - other criteria
- It is important for the lab to understand how the EQA acceptable ranges are set so that they can properly interpret their EQA report

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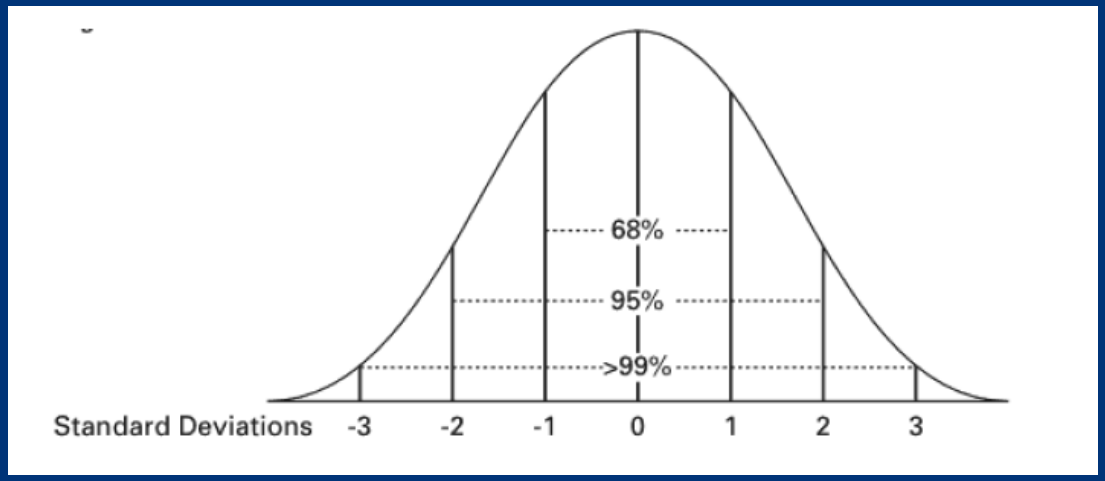
Using Statistical Comparison



- Mean ± 2 SD = 95% returned results are acceptable
- This gives information on whether your result is acceptable compared with all results and your method
- But does it give information on whether your result is acceptable compared to the ‘true’ patient result?
- Would your result alter the clinical management of the patient?

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Clinical Need

- What amount of analytical variability (imprecision &/or bias) added to the ‘true’ test variability (biological) is acceptable so that the patient can still have good clinical management?
- Biological = biological variation

Biological Variation

- The diverse manifestations of ‘normal’ that exist between people
- The variation in a parameter due to physiological differences within individuals and between individuals
- Each individual has random fluctuations around a homeostatic set point
- These homeostatic set points will vary between individuals

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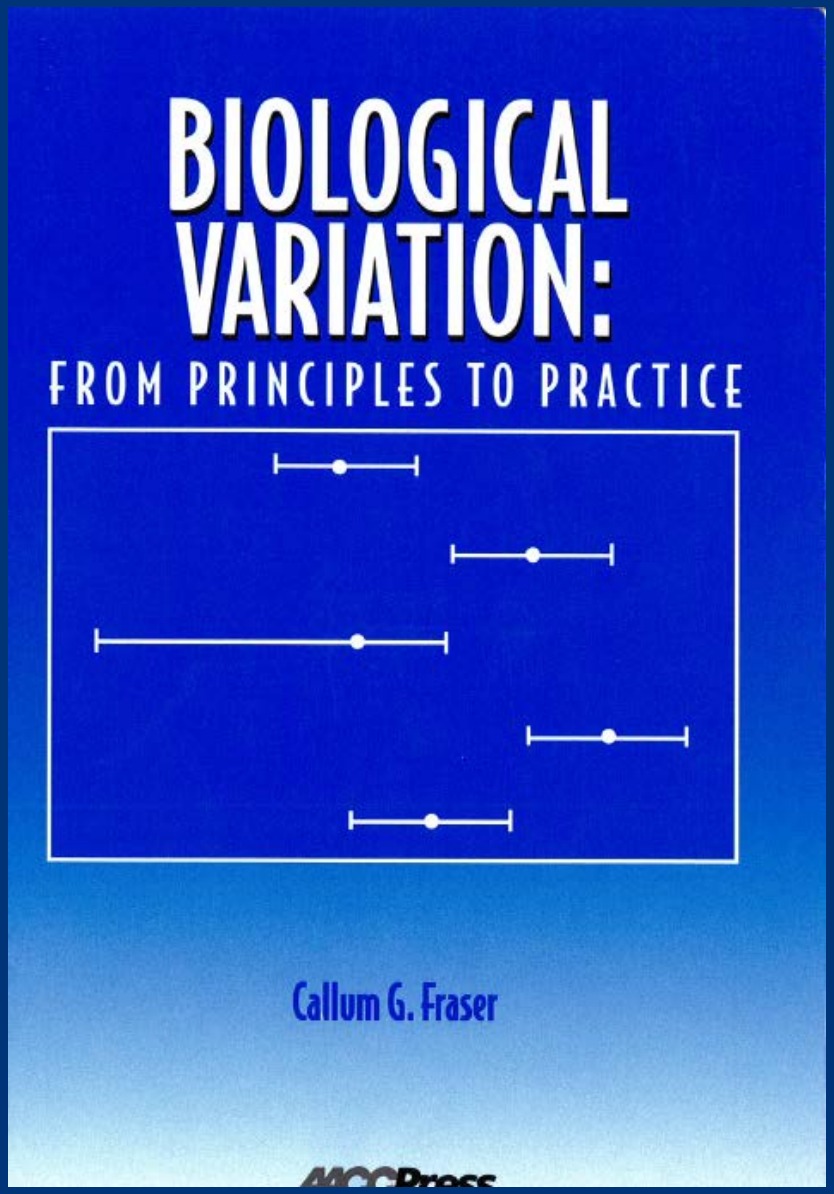

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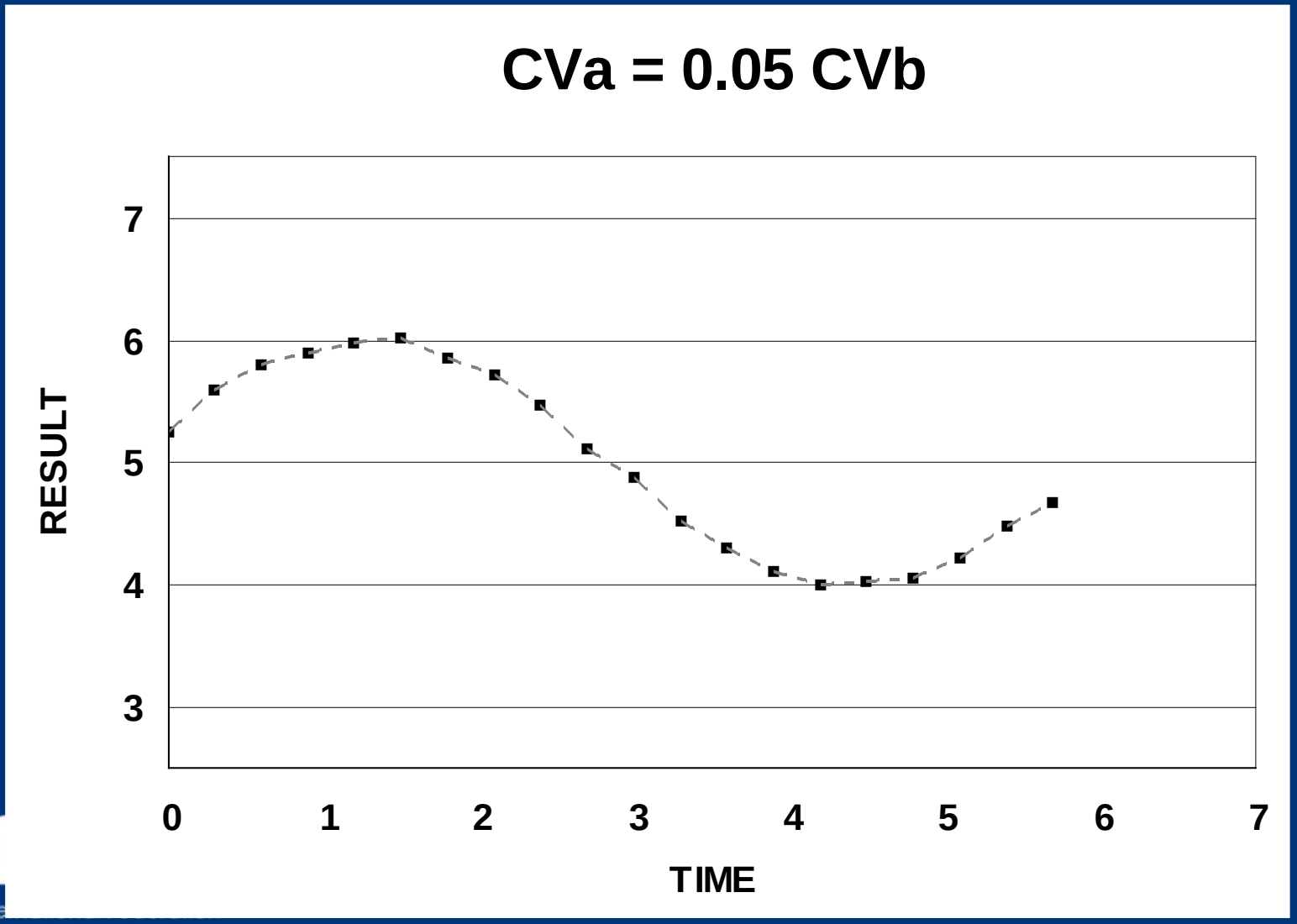
The Effect of Analytical Variability



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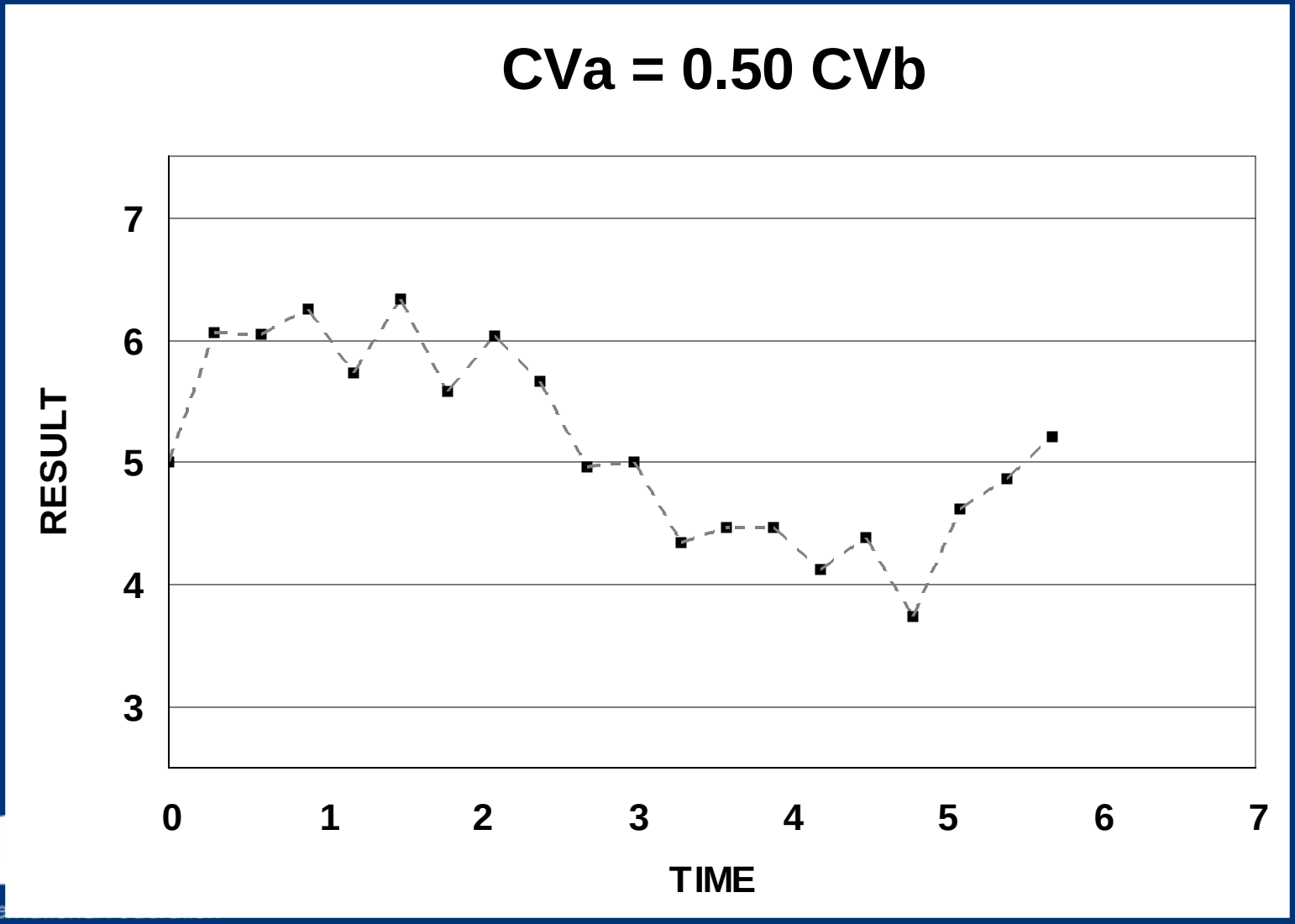
* Dr Ken Sikaris

The Effect of Analytical Variability



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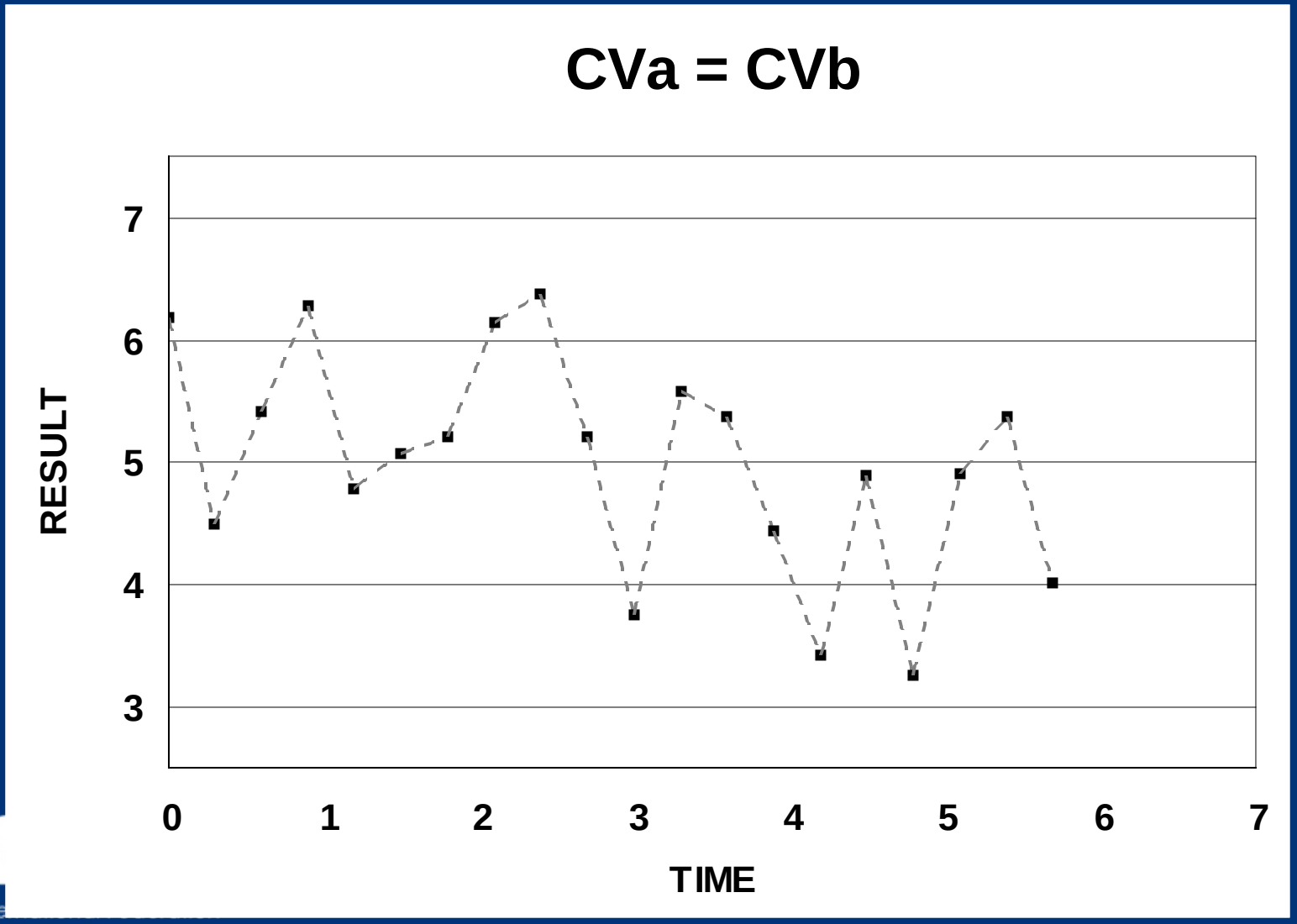
The Effect of Analytical Variability



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STRATEGIES TO SET GLOBAL QUALITY SPECIFICATIONS IN LABORATORY MEDICINE

WORLD HEALTH ORGANIZATION  ORGANISATION MONDIALE DE LA SANTE

International Union of Pure and Applied Chemistry

Nobelforum,
Karolinska Institutet
Stockholm April 24-26, 1999

Stockholm Hierarchy

1. Studies on clinical outcomes
2. Clinical decisions in general, data from:
   - biological variation
   - clinicians' opinions
3. Published professional recommendations
4. Performance goals set by regulatory bodies or organisers of External Quality Assessment Schemes.
5. Goals based on the current state of the art as demonstrated by data from EQA or published method papers

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Acceptable Ranges

- It is important for the lab to understand how the EQA acceptable ranges are set so that they can properly interpret their EQA report

EQA Reports

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What to Look for in EQA Reports

- What is the turn around time?
  - how long after the due date will you receive your report?
  - the earlier the better
  - can remember what was happening in the lab
  - can take corrective action sooner
- Is the report electronic or paper?
  - what suits me best?

What to Look for in EQA Reports

- Design should be such that the user can:
  - understand
  - take appropriate action
  - provide education
  - achieve EQA goals

What to Look for in EQA Reports

- Report should show
  - laboratory performance
  - comparison with target value
  - comparison with all results
  - comparison with method group
  - performance over time

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What to Look for in an EQA? Scientific Validity & Reliability

- accredited proficiency testing scheme provider
- international accreditation
- ISO/IEC 17043
- Conformity Assessment – General Requirements for Proficiency Testing
- assures you that the EQA provider itself has a quality policy

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Education from EQA: Data

- Frequency of methods used
- Performance of methods used
    - accuracy
    - precision
- Susceptibility of methods to interference
    - including other analytes and matrix
- Interpretation of results

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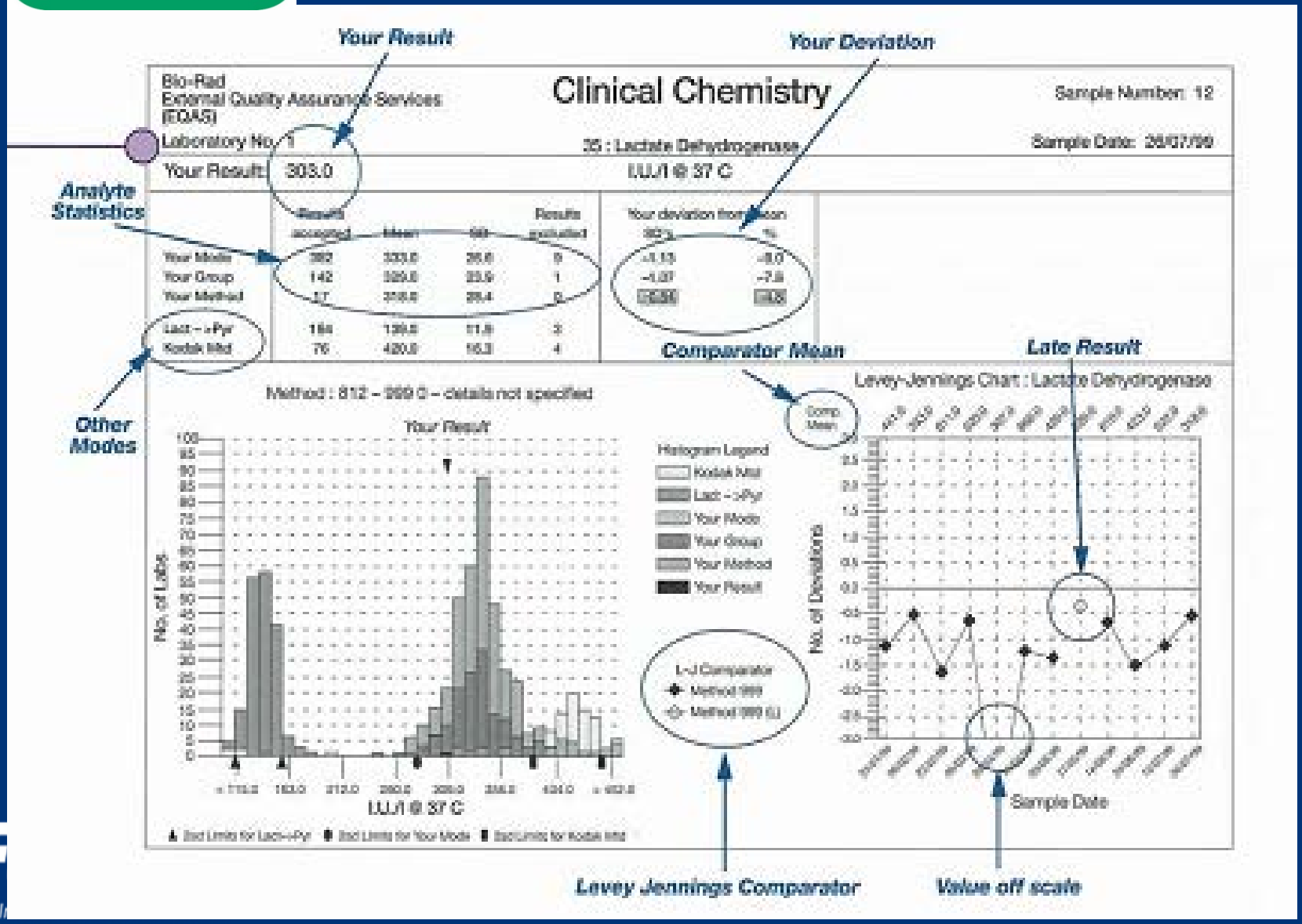
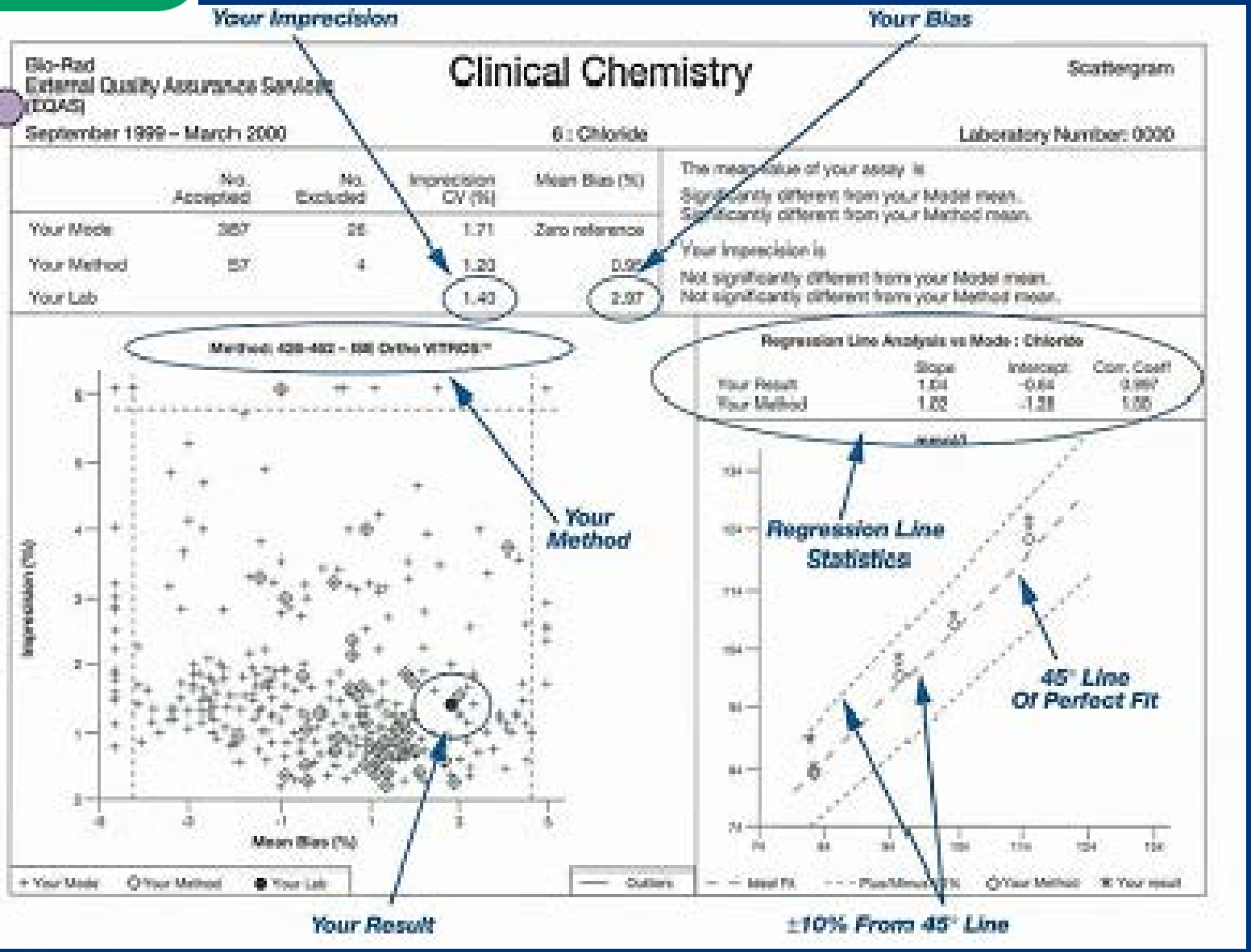


BIO-RAD



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Education from EQA

- Education on methods and interferences
- eg HbA1c
  - renal failure patients have high levels of carbamylated haemoglobin
  - carbamylated Hb + HbA1c detected by some methods eg HPLC
  - leads to falsely high HbA1c results
  - EQA organisers can include special samples with carbamylated Hb added for labs to test their method

Education from EQA

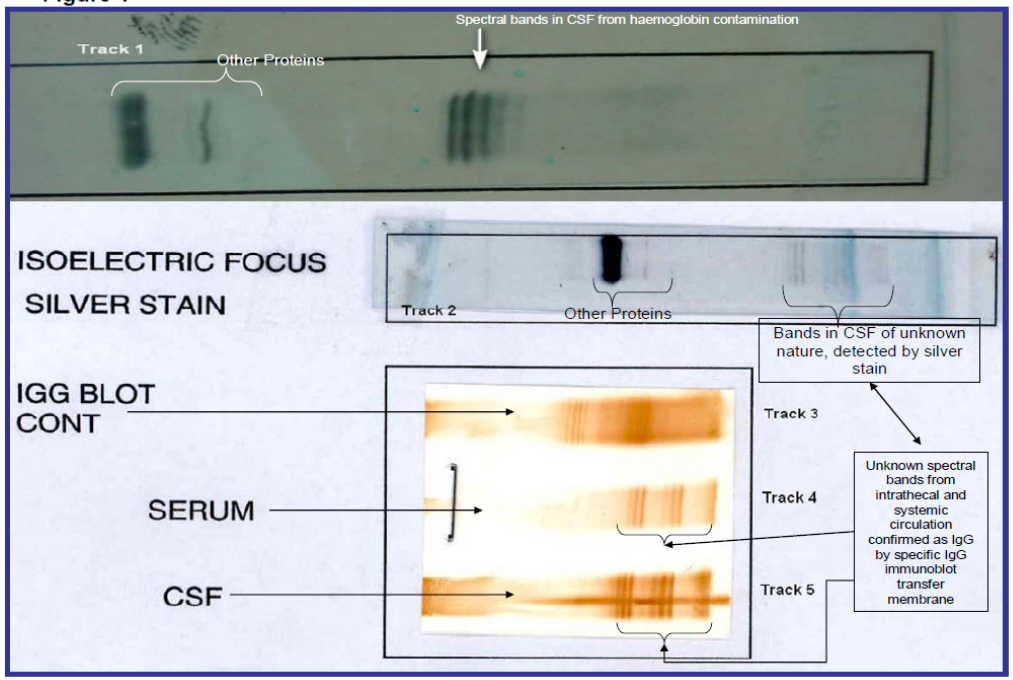
RCPA Quality Assurance Programs Pty Limited

Immunology

False Positive Oligoclonal Banding in CSF due to Haemoglobin

The following information has been provided by the CSF Working Party to demonstrate the difference between Hb and Oligoclonal IgG bands

Figure 1



Haemoglobin bands can be mistaken for oligoclonal bands in CSF if an immunological detection technique is not used (See Figure 1.)

Scientific Support

- Does the EQA organiser provide a consultation service?
- Available by phone, fax, e-mail
- Individual labs can request help with
  - method classification queries
  - analyte problems
  - report interpretation
  - troubleshooting

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