Proficiency testing a useful tool to check your lab performance

O.S.N.M. Smeets

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Koninklijke Nederlandse Maatschappij ter bevordering der Pharmacie
KNMP
Wetenschappelijk Instituut Nederlandse Apothekers
WINAp

Proficiency testing

- What is proficiency testing?
- Important aspects of proficiency testing
- Results of 1999-2006

Pharmacy in The Netherlands

- 1600 Community and 80 Hospital Pharmacies
- Home made preparations by the Community Pharmacy : 5%
- Home made preparations by the Hospital Pharmacy : 8 - 10%
- Quality control by hospital Lab or Regional Lab

Scientific Institute Dutch Pharmacists
The Hague, The Netherlands

Laboratory of the Dutch Pharmacists

Laboratory of the Dutch Pharmacists

Definition interlaboratory study

Any study requiring the active participation of more than one laboratory to obtain the desired information

Types of interlaboratory studies

- Method-Performance Study
- Material-Certification Study
- Proficiency testing

Laboratory performance study

- To check your routine performance
- World wide used
- Open OR closed
- Method is your own choice
- Learning instead of qualifying process

Important aspects for the organiser of a proficiency testing study

- Reference value
- Sample quality and quantity
- Evaluation and presentation of results
- Time schedule

Reference value

- True value (based on production figures)
- Assigned value (based on result expert lab)
- Consensus value (based on results participants)

Our approach :

Combination of assigned value and true value

Assigned value = True value ✂ 1%

Sample quality and quantity

- Homogeneous
- Stable
- Quantity

Evaluation and presentation of results

- Confidentiality
- No correction of results
- Ranking of results
- Histogram of relative contents
- Method of analysis is reported

Time schedule

- Objective of the study
- Sample preparation and control
- Distribution to participants
- Participants analyse the samples
- Results are collected
- Evaluation of all results
- Final reports are sent to participants

Factors affecting the lab result

- Experience or competence of the analyst
- Similarity of the matrix of the PT-sample to the Laboratory's routine samples
- Similarity of the level of the analyte to the Laboratory's routine samples
- Transcription or miscalculation errors
- Poor quality reagents
- Poorly calibrated apparatus
- Broken or poorly maintained glassware
- Technique or method being unsuitable

Reasons for participating in proficiency testing study

- Accreditation requirement
- To help gain accreditation
- Customer requirement
- Regulatory requirement
- Company policy
- As part of quality system
- To evaluate method/instrument

Summary of FIP-LMCS PT-Programms

- 1999 17 Labs 15 Countries 4 Samples
- 2000 40 Labs 33 Countries 2 Samples
- 2001 56 Labs 45 Countries 5 Samples
- 2002 53 Labs 40 Countries 2 Samples
- 2003 49 Labs 43 Countries 4 Samples
- 2004 54 Labs 45 Countries 4 Samples
- 2005 43 Labs 37 Countries 3 Samples
- 2006 45 Labs 39 Countries 4 Samples

Participants of the PT-Programme

	1999	2000	2001	2002	2003	2004	2005	2006
• Europe	14	17	26	25	19	22	19	18
• Africa	1	4	11	9	10	10	6	9
• Asia	1	13	11	13	13	13	13	13
• N-America	-	1	2	1	1	2	1	1
• S-America	-	4	5	4	5	6	3	4
• Pacific	1	1	1	1	1	1	1	0
TOTAL	17	40	56	53	49	54	43	45

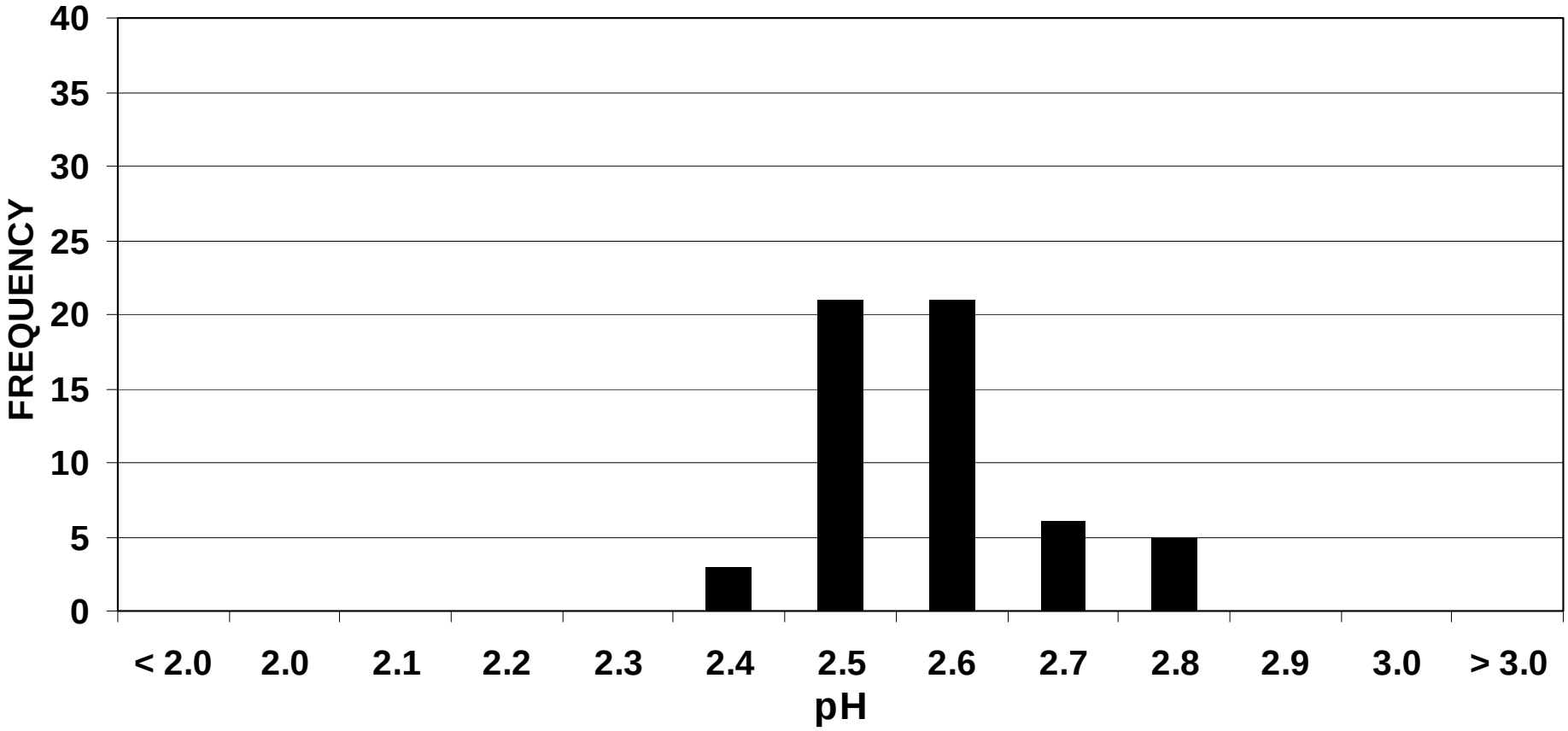
Samples

- 1999 3 Buffer solutions for pH-testing
  Salicylic acid solution 2%
- 2000 Theophylline solution
  Zinc ointment
- 2001 3 Buffer solutions for pH-testing
  Lidocaïne HCl injection
  Potassium chloride oral solution
- 2002 Magnesium sulphate injection 200 mg/ml
  Salicylic acid solution 2%

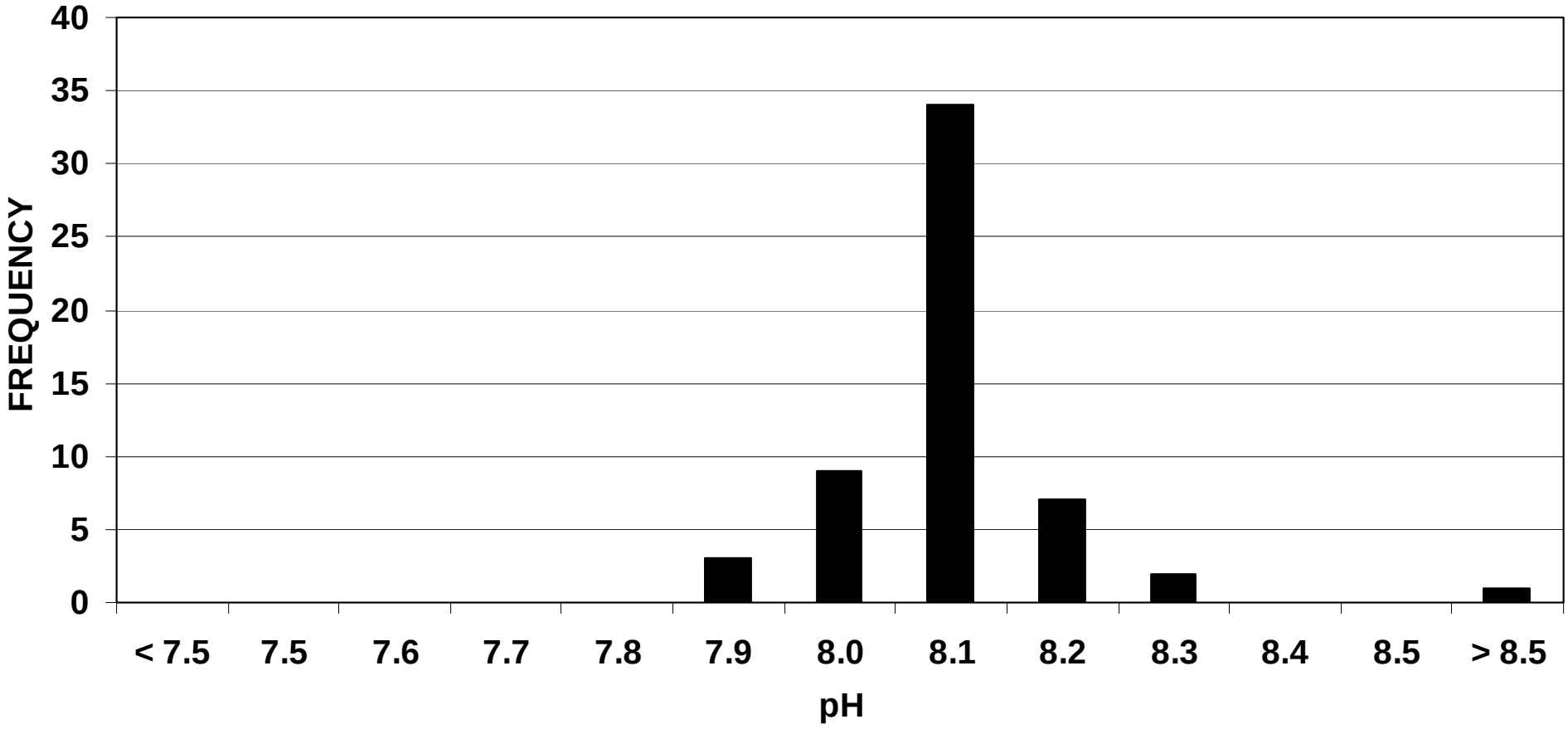
Samples

- 2003 Sodium Thiosulphate Injection 250 mg = 1 ml
  Isoniazid Injection 200 mg = 2 ml
  2 Buffer solutions for pH-testing
- 2004 Caffeine Injection 20 mg = 2 ml
  Raw material for melting point testing
  2 Buffer solutions for pH-testing
- 2005 Prednisolone Oral Solution 1.34 mg/ml
  1 Buffer solution for pH-testing
  Performance testing UV-absorption
- 2006 Lidocaïne Hydrochloride monohydrate
  Injection 10 mg = 1 ml
  2 Buffer solutions for pH-testing
  Sodium Chloride Solution P% for osmolality

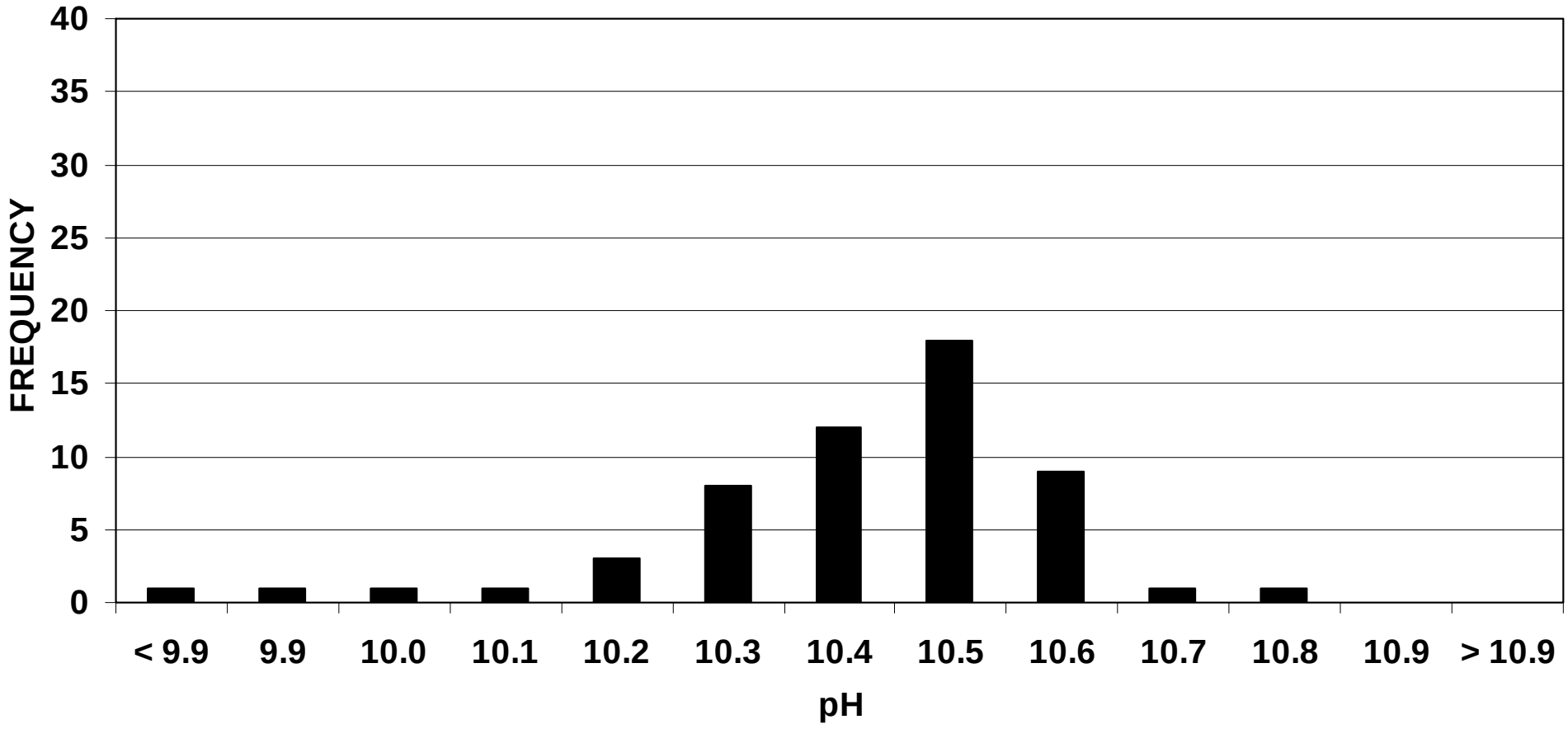
pH Buffer Solution X
FIP Proficiency Testing 2001



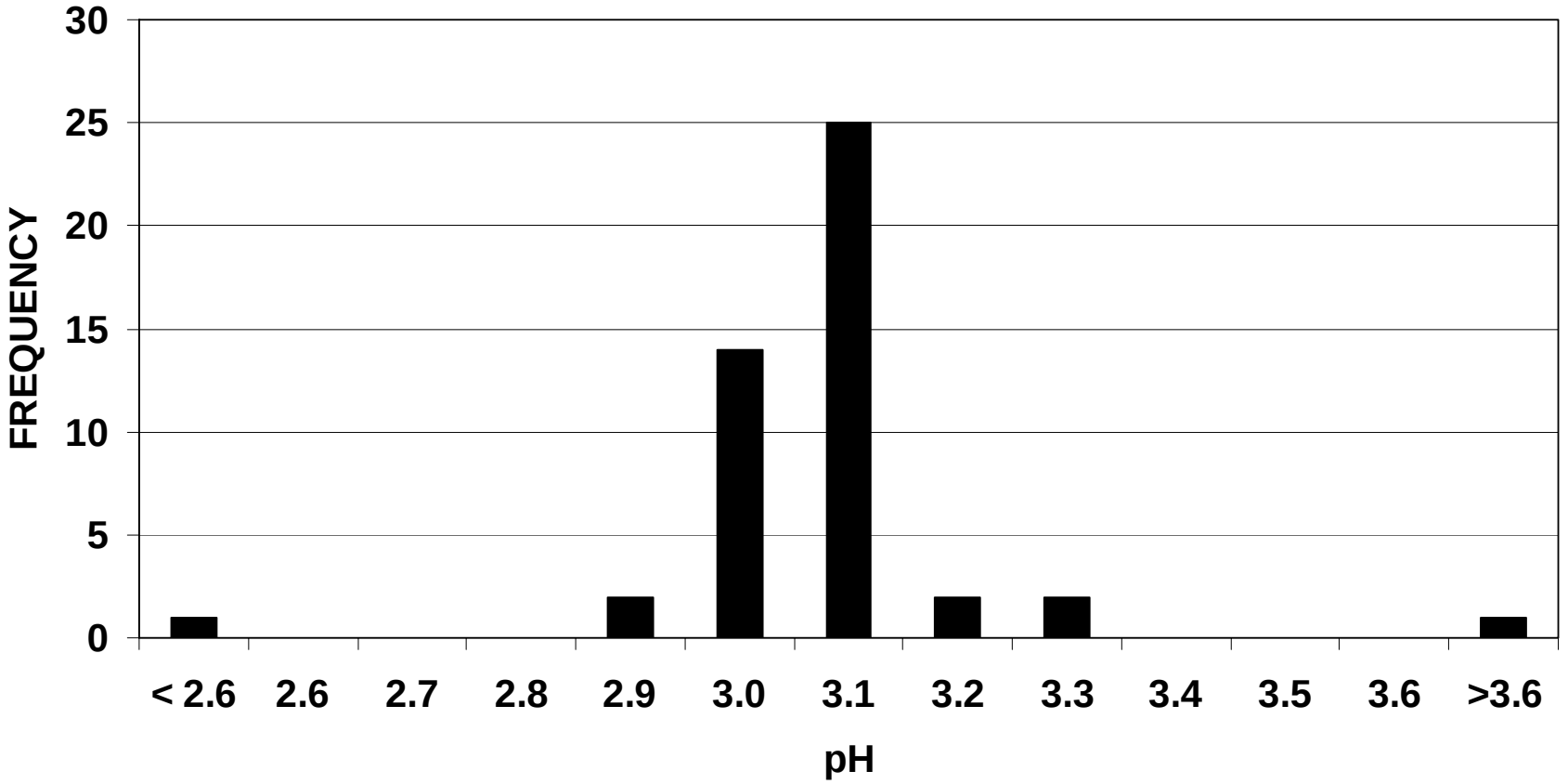
pH Buffer Solution Y
FIP Proficiency Testing 2001



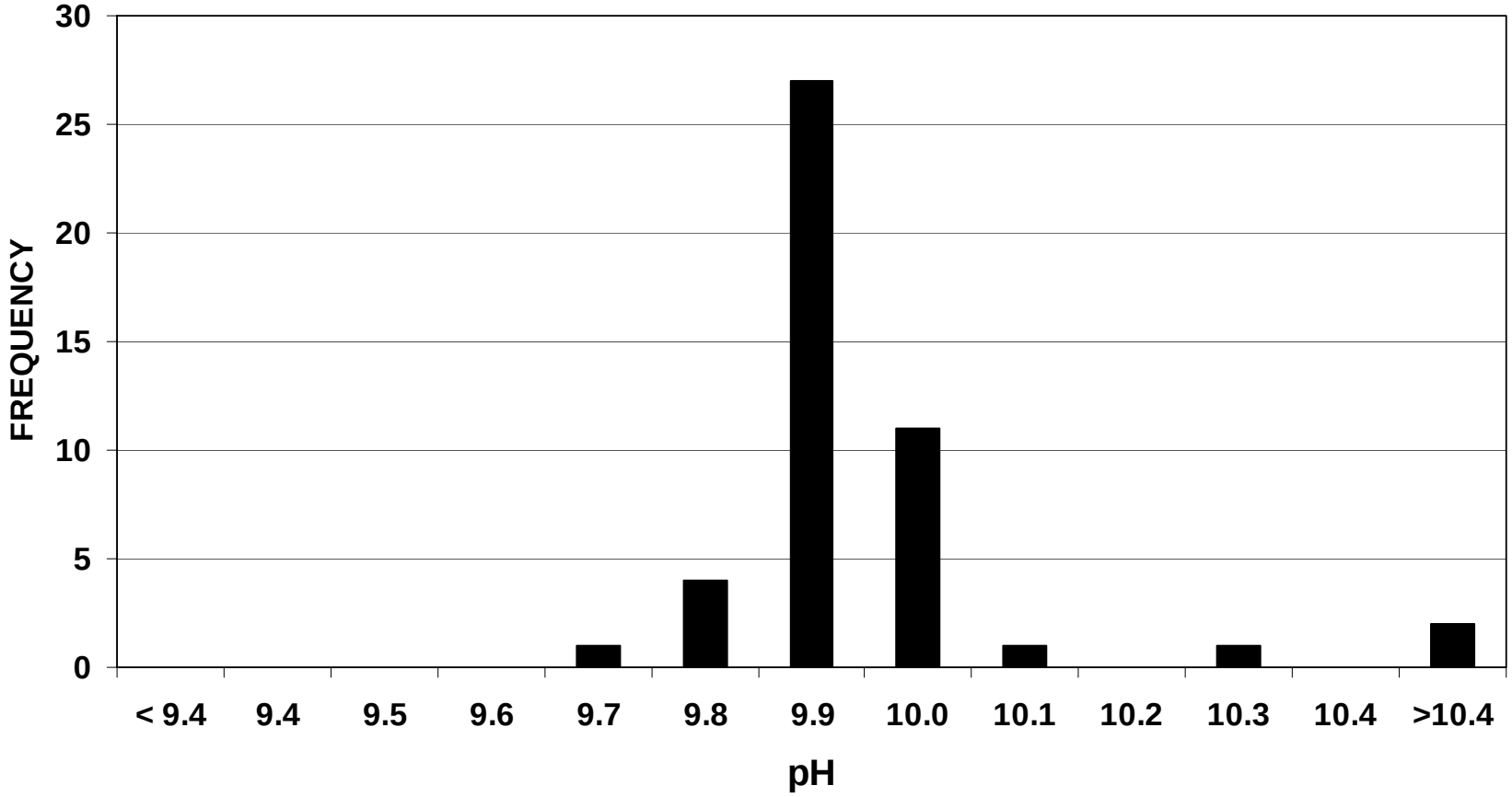
pH Buffer Solution Z
FIP Proficiency Testing 2001



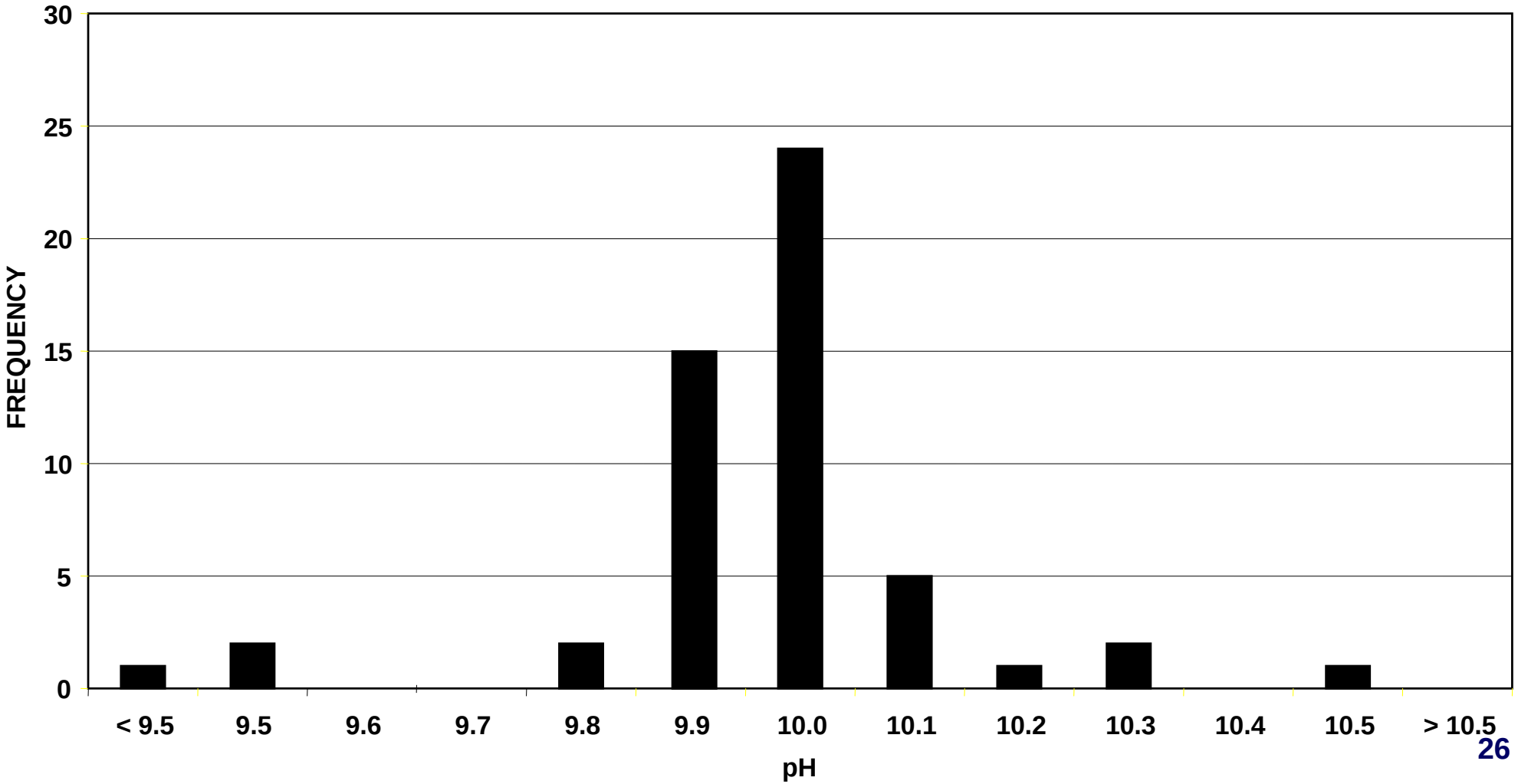
pH Buffer Solution T
FIP Proficiency Testing 2003



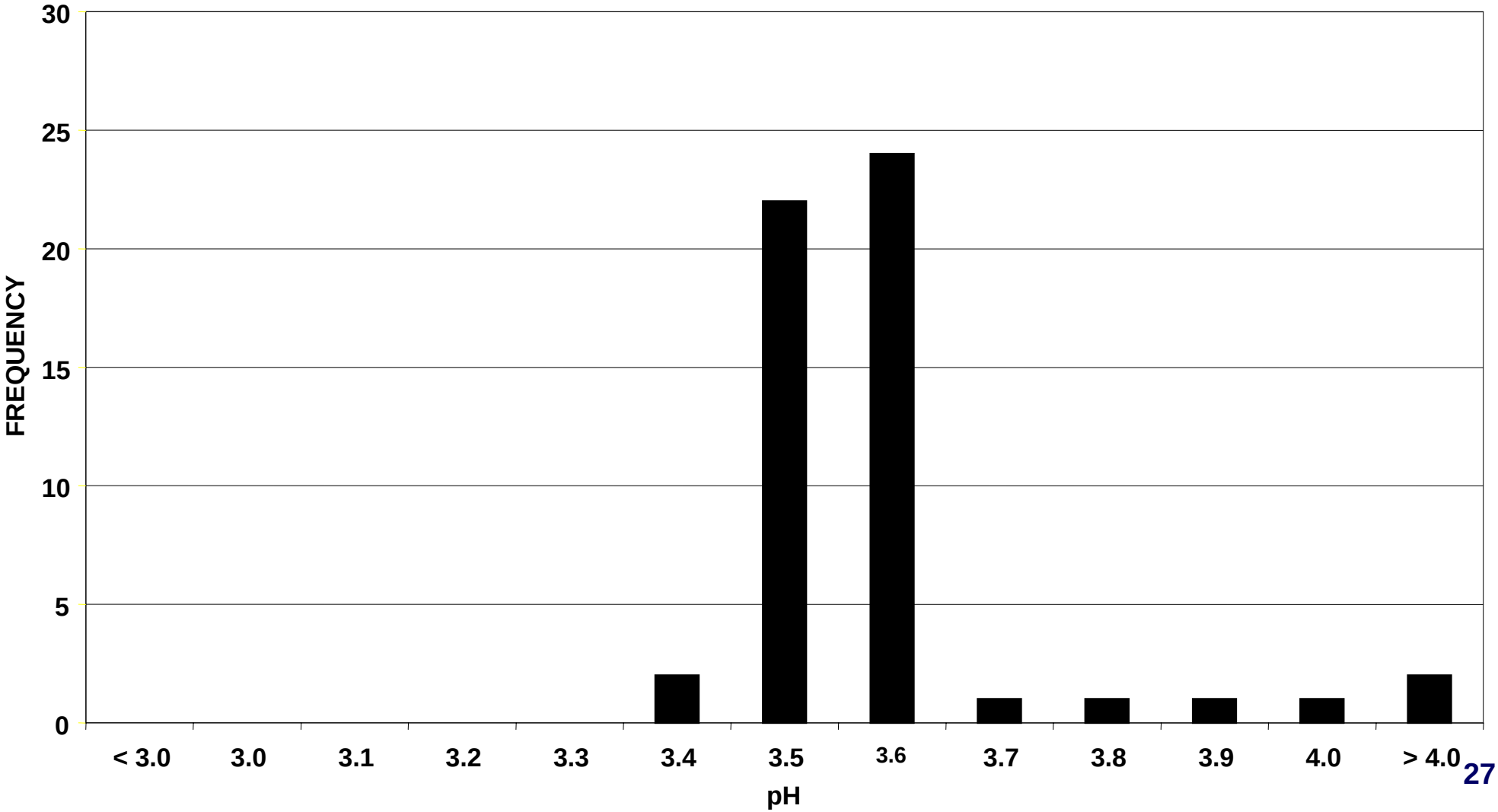
pH Buffer solution U
FIP Proficiency testing 2003



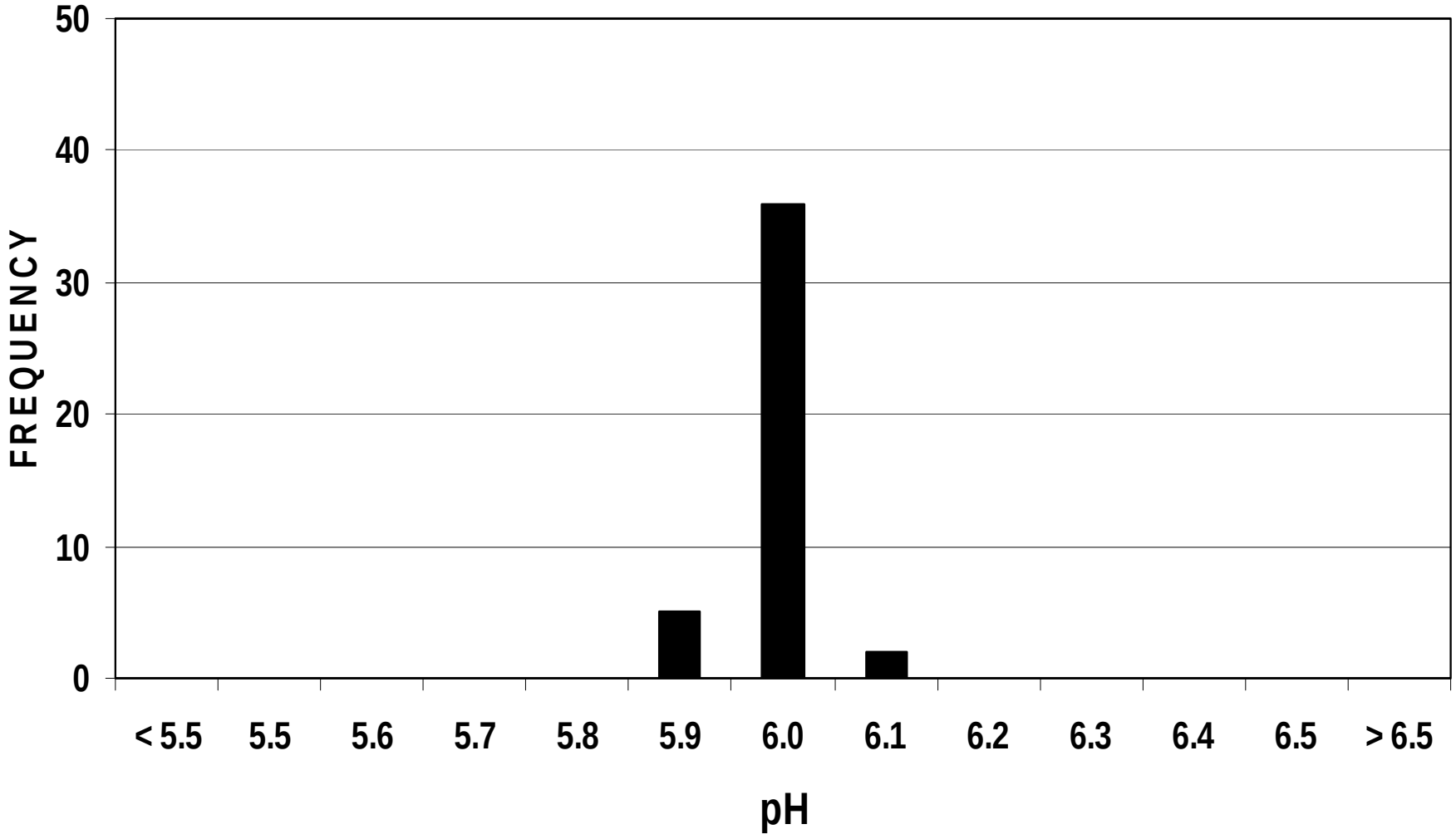
pH Buffer Solution D
FIP Proficiency Testing 2004



pH Buffer Solution E
FIP Proficiency Testing 2004



pH Buffer Solution M
FIP Proficiency Testing 2005



FIP Proficiency Testing 2006
pH Buffer Solution

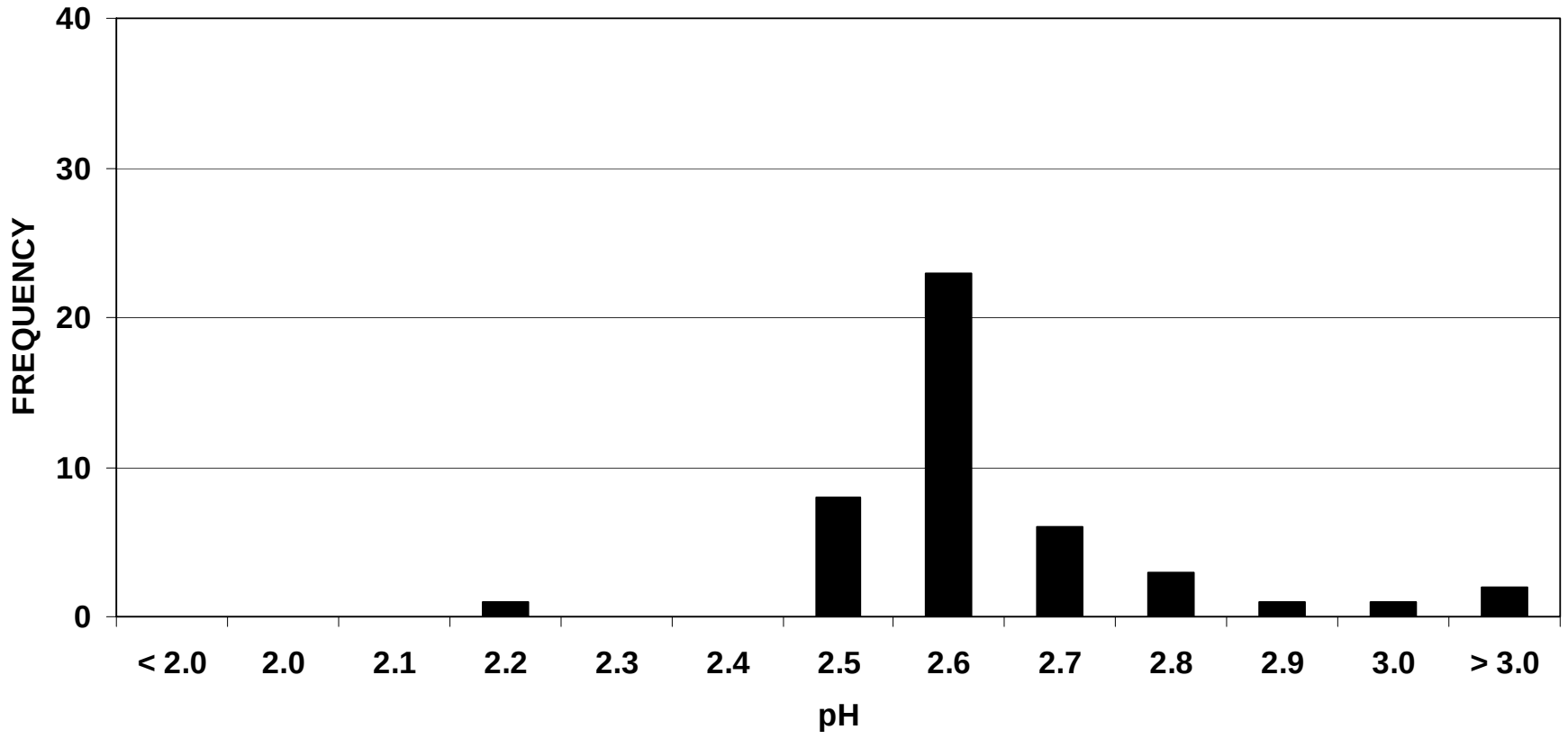
- K = Buffer solution [phosphate] pH 2.5
- L = Buffer solution [acetate] pH 4.6

Results FIP Labs Buffer Solution K

Buffer solution pH 2.5

- 45 results
- Reference value : 2.5
- Mean value (all participants) : 2.7
- Mean value (excluding the outliers 4.6 and 5.5) : 2.6
- 69% of the pH-results were between 2.4 - 2.6

pH Buffer Solution K
FIP Proficiency Testing 2006

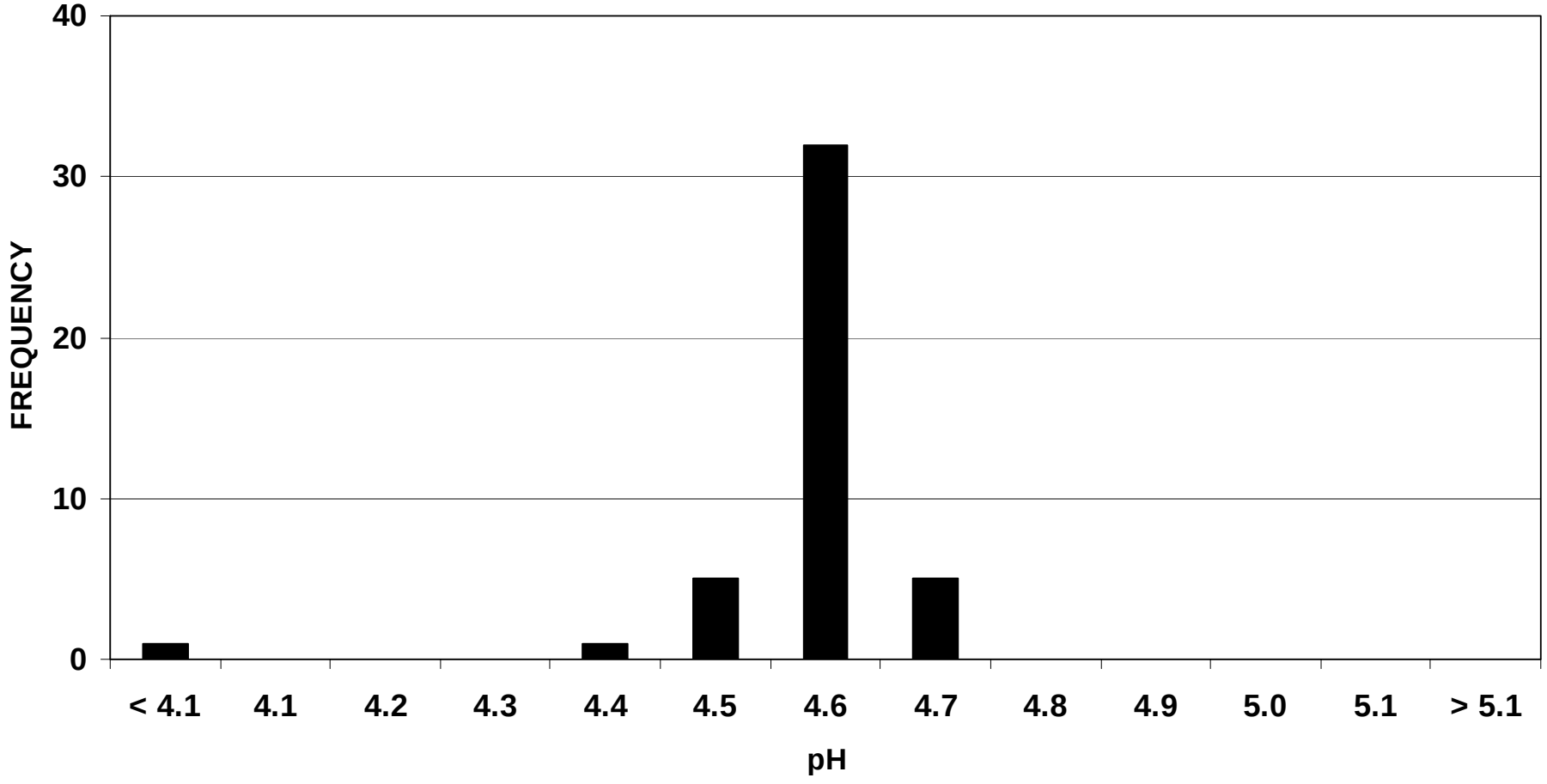


Results FIP Labs Buffer Solution L

Buffer solution pH 4.6

- 44 results
- Reference value : 4.6
- Mean value (all participants) : 4.5
- Mean value (excluding the outlier 2.55) : 4.6
- 95% of the pH-results were between 4.5 - 4.7

pH Buffer Solution L
FIP Proficiency Testing 2006



Summary pH testing

1999	pH	FIP (n=17) ± 0.1	Netherlands (n=197) ± 0.1
• Buffer solution A	2.0	94%	88%
• Buffer solution B	5.9	100%	96%
• Buffer solution C	11.1	47%	80%

2001	pH	(n=56) ± 0.1	(n=184) ± 0.1
• Buffer solution X	2.5	80%	84%
• Buffer solution Y	8.0	82%	86%
• Buffer solution Z	10.4	68%	71%

Summary pH testing

2003	pH	FIP (n=47) ✂ 0.1	Netherlands (n=170) ✂ 0.1
• Buffer solution T	3.1	87%	95%
• Buffer solution U	9.9	89%	92%

2004	pH	(n=53/54) ✂ 0.1	(n=172) ✂ 0.1
• Buffer solution D	10.0	83%	88%
• Buffer solution E	3.5	89%	96%

Summary pH testing

2005		FIP (n=43)	Netherlands (n=176)
	pH	✂ 0.1	✂ 0.1
• Buffer solution M	6.0	100%	100%

2006		(n=45/44)	(n=176)
	pH	✂ 0.1	✂ 0.1
• Buffer solution K	2.5	69%	81%
• Buffer solution L	4.6	96%	97%

pH : Possible sources of error

- Instrument performance
- Procedure of Calibration
- Quality Calibration Buffers

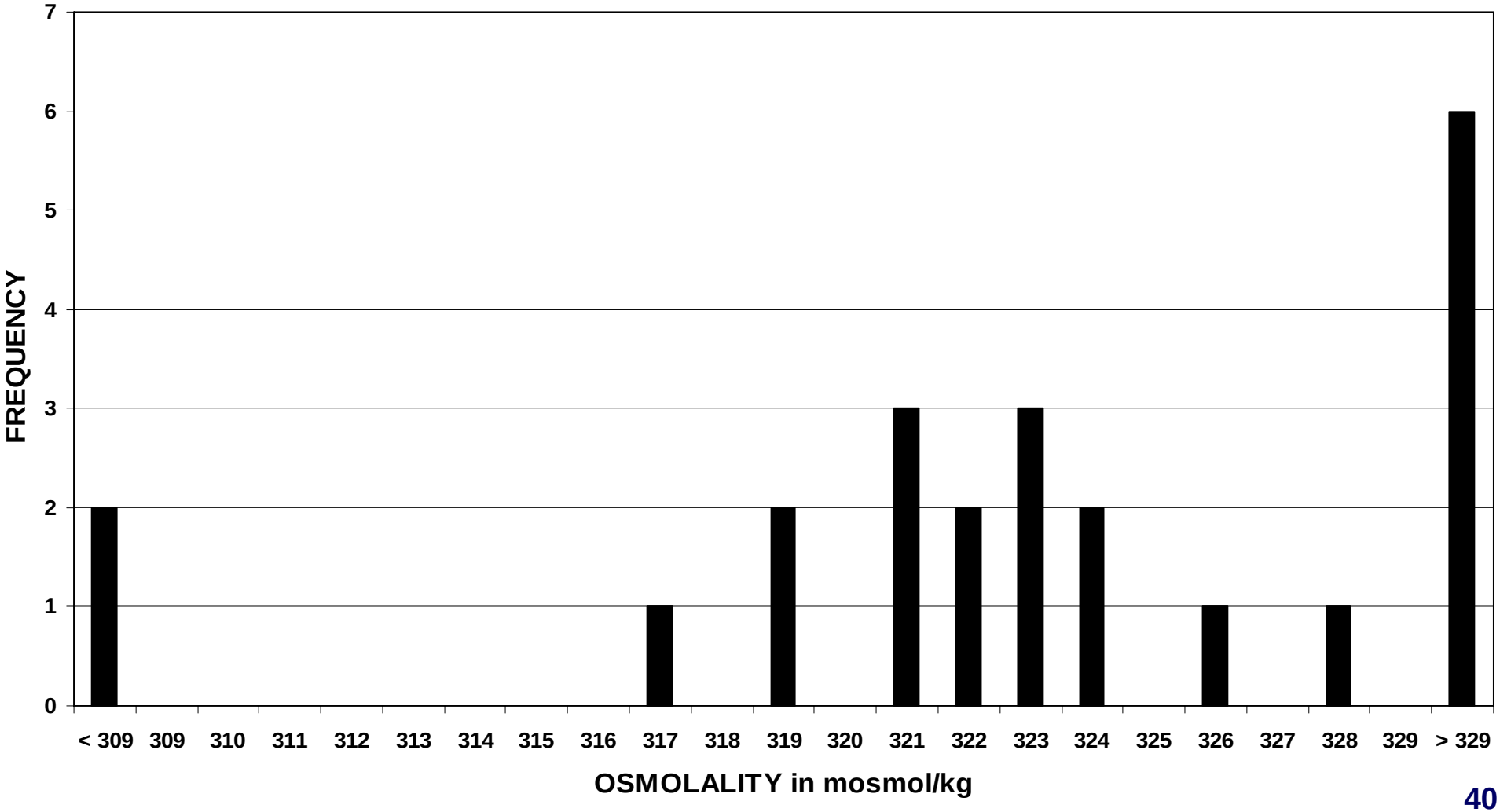
Composition Sodium Chloride Solution P% for testing the osmolality

- Sodium Chloride 9.9 g
- Disodium edetate 1.0 g
- Benzalkonium Chloride Solution 50% $^{m}/_{v}$ 0.2 g
- Water, purified sufficient to produce 1000 ml

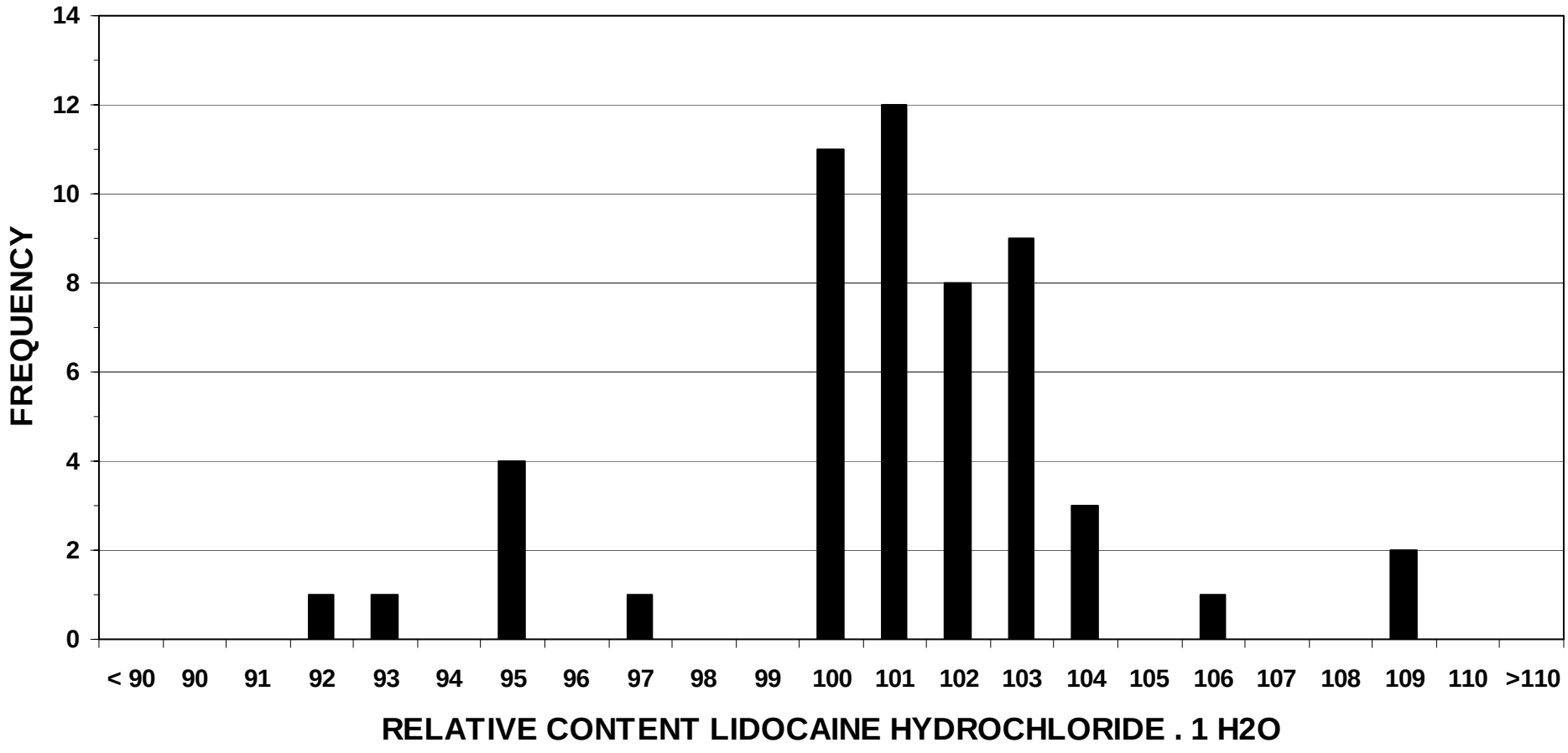
Results FIP Labs
Sodium Chloride Solution P% 2006

- 23 results
- Reference value : 319 mosmol / kg
- Mean value (excluding101) : 331 mosmol / kg
- 57% of the results were between 314 - 324 mosmol / kg

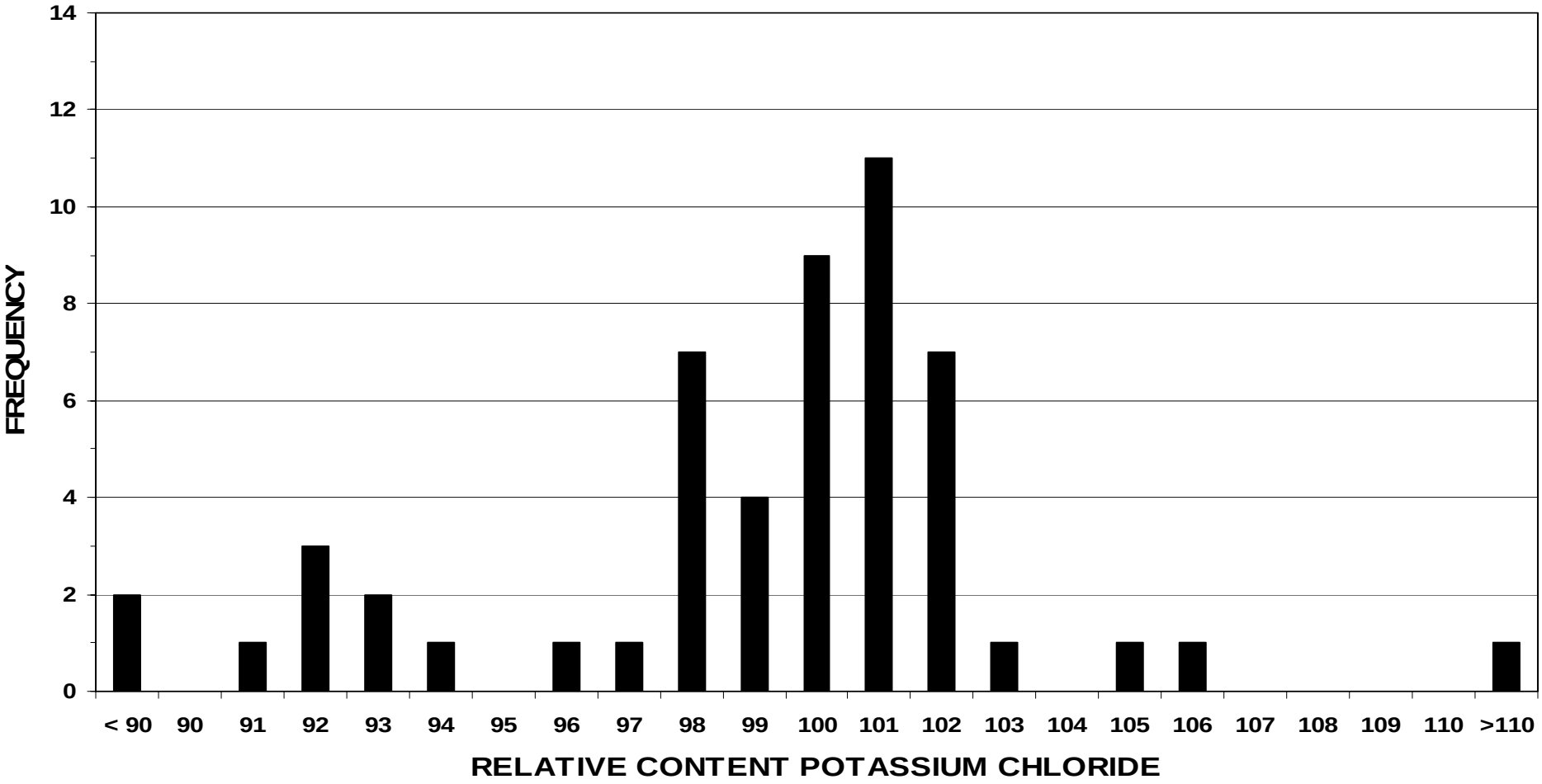
Osmolality of Sodium Chloride Solution P%
FIP Proficiency Testing 2006



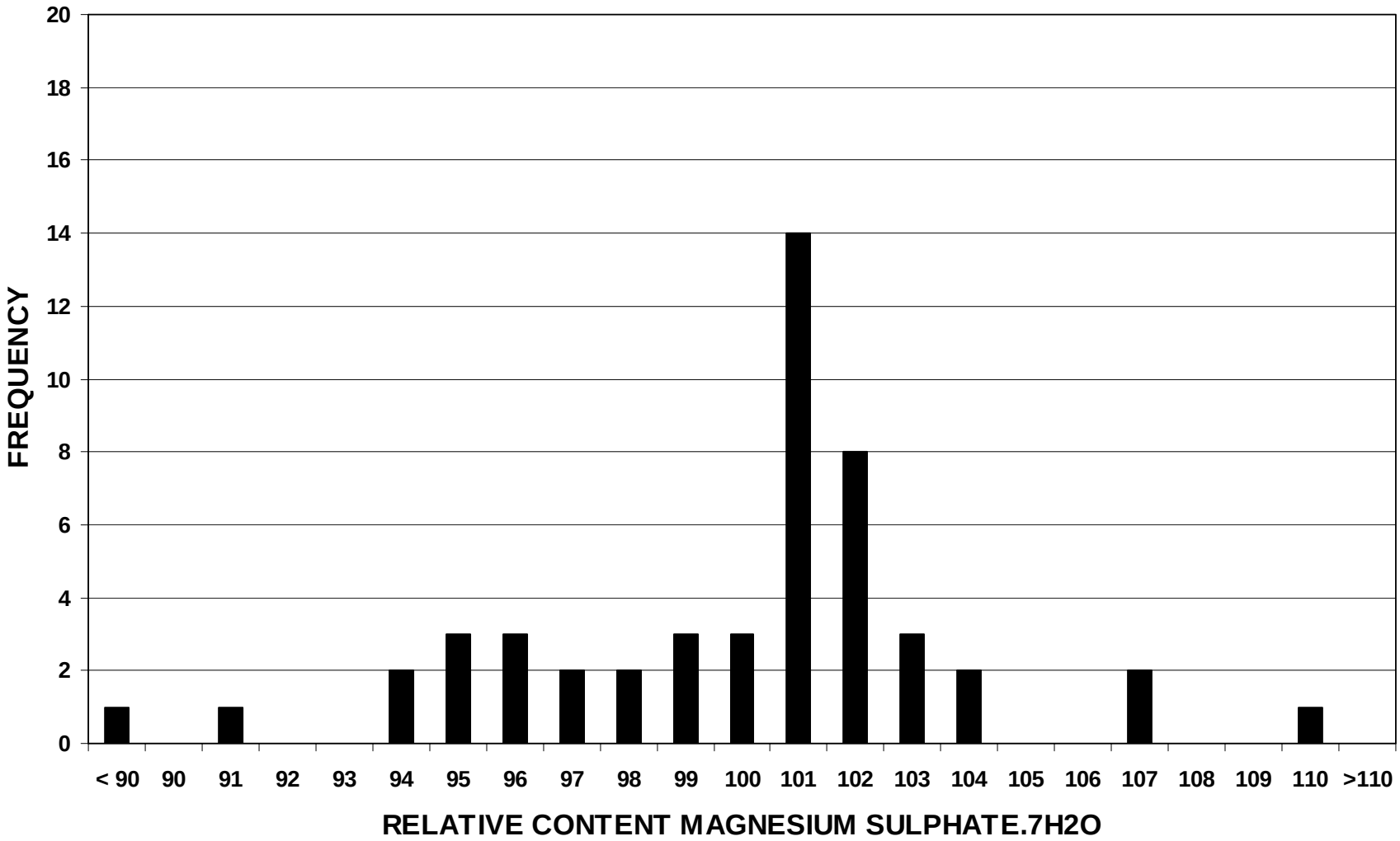
Lidocaine Hydrochloride Injection 1 ml = 10 mg
FIP Proficiency Testing 2001



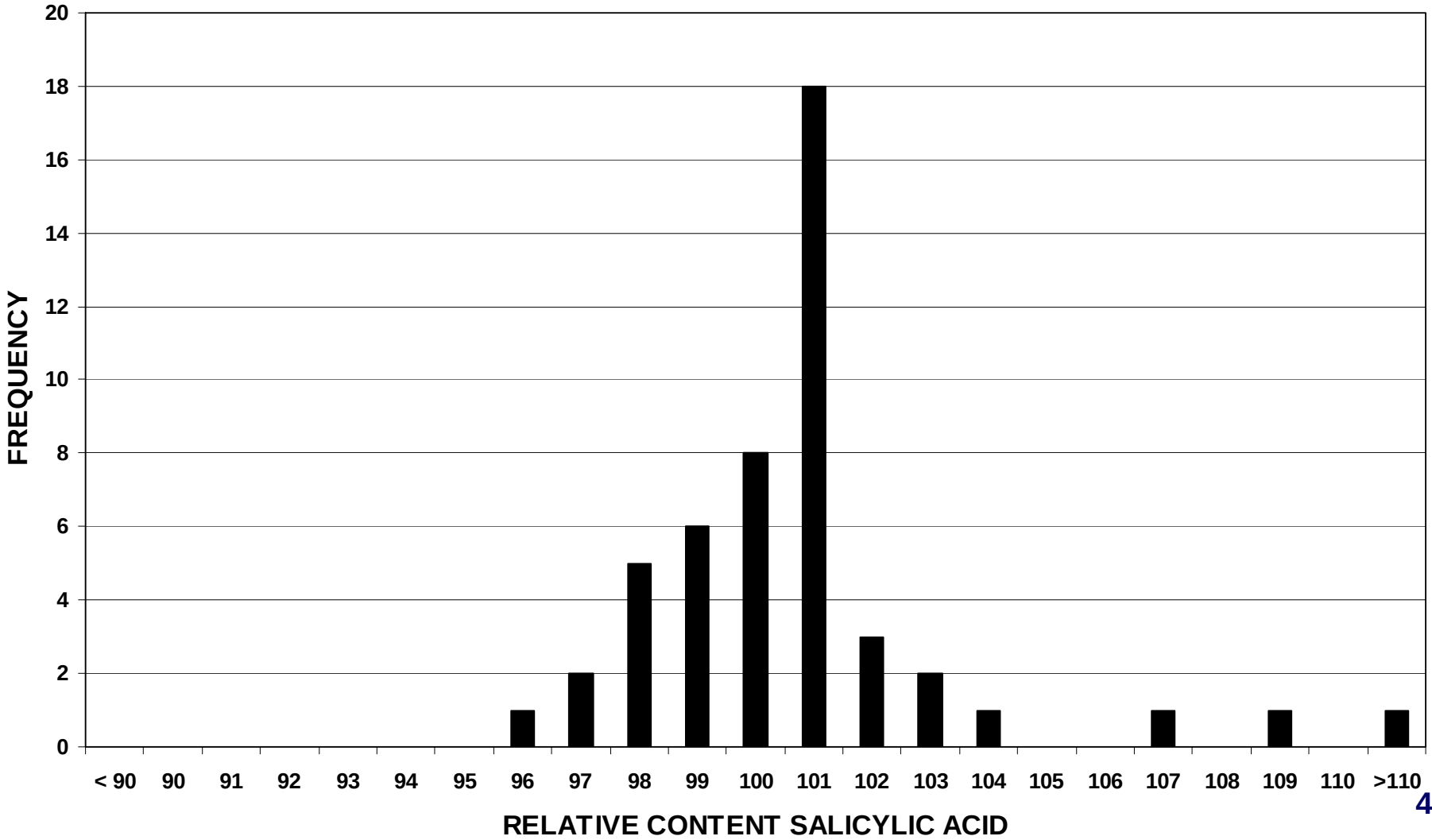
Potassium Chloride Oral Solution 75 mg/ml
FIP Proficiency Testing 2001



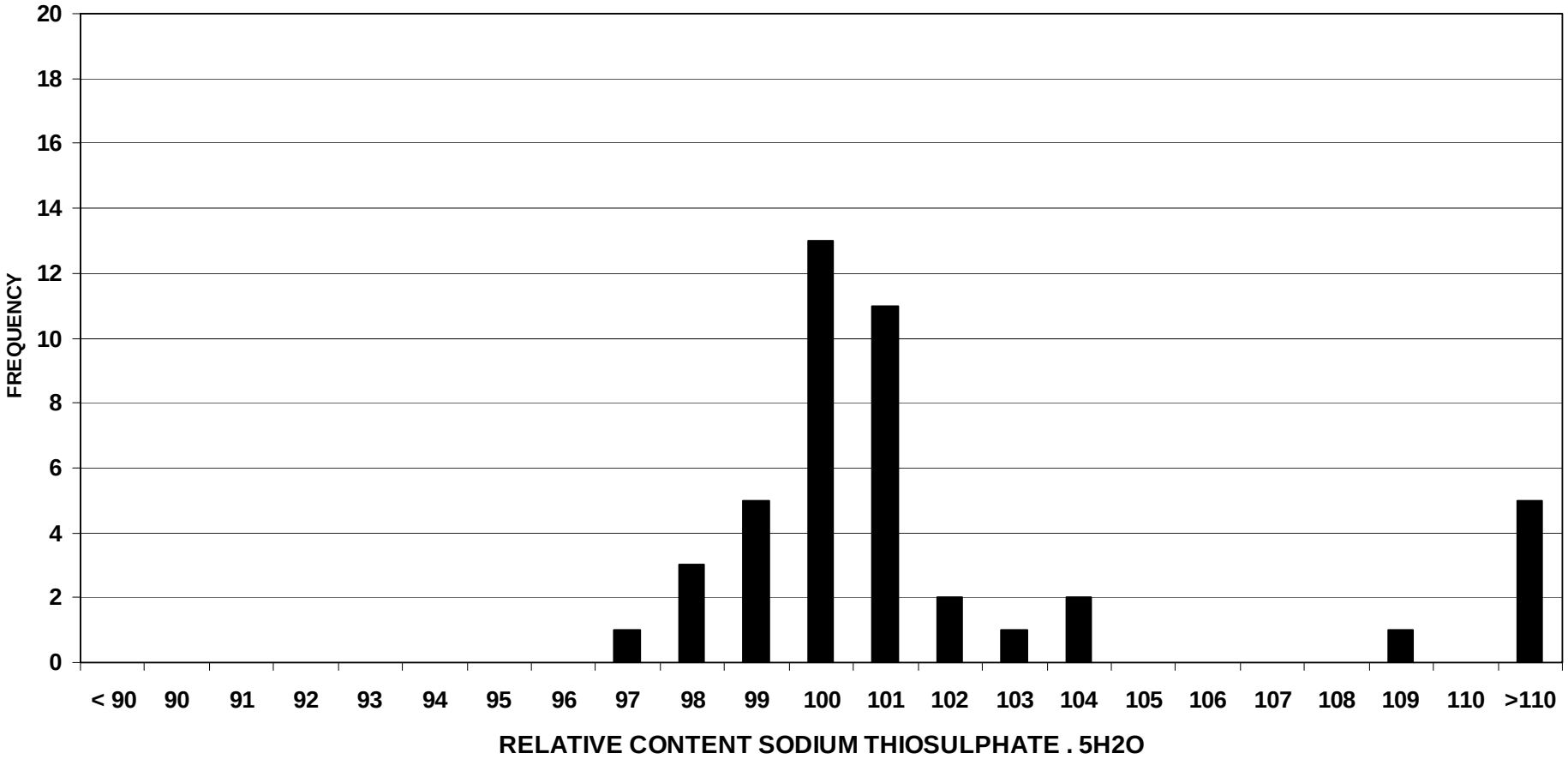
Magnesium Sulphate Injection 200 mg/ml
FIP Proficiency Testing 2002



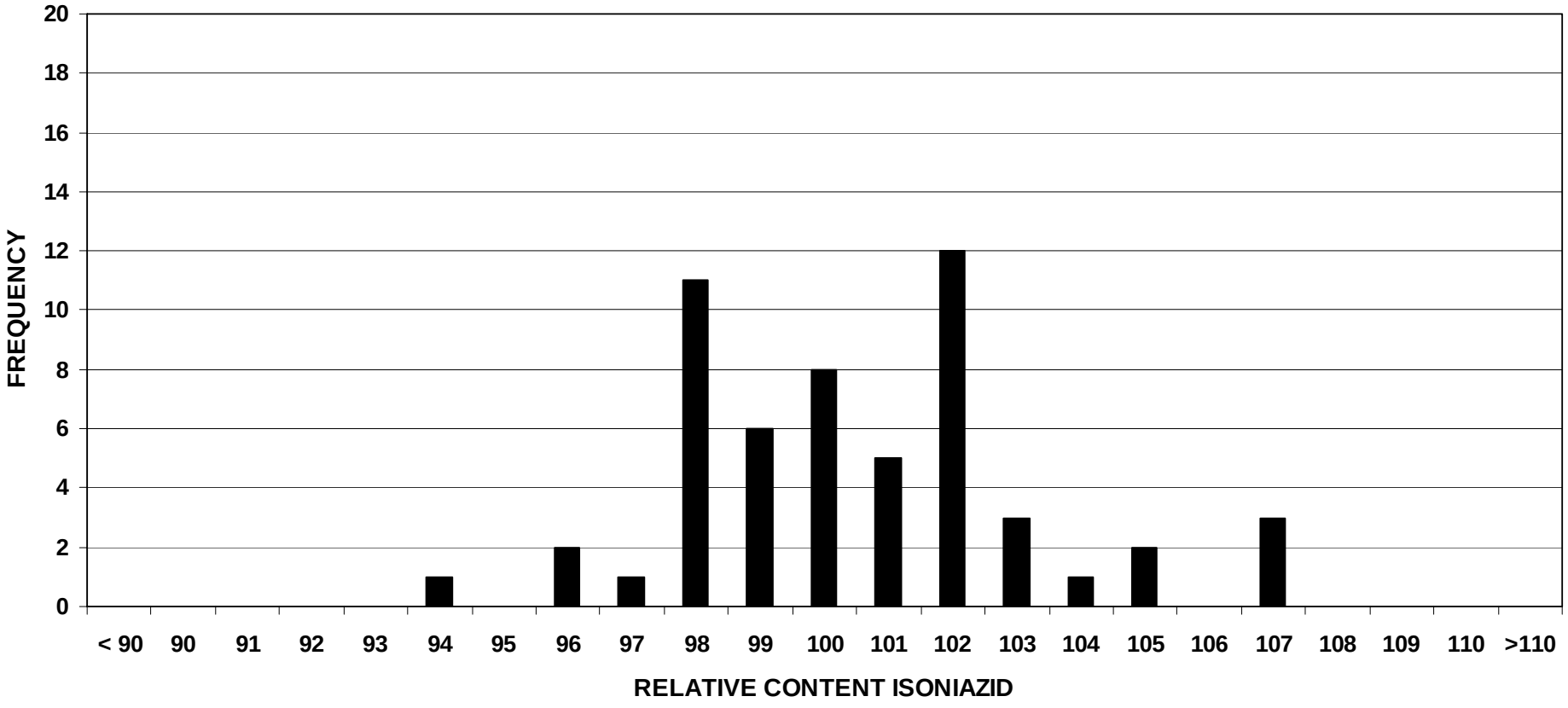
Salicylic Acid Solution 2%
FIP Proficiency Testing 2002



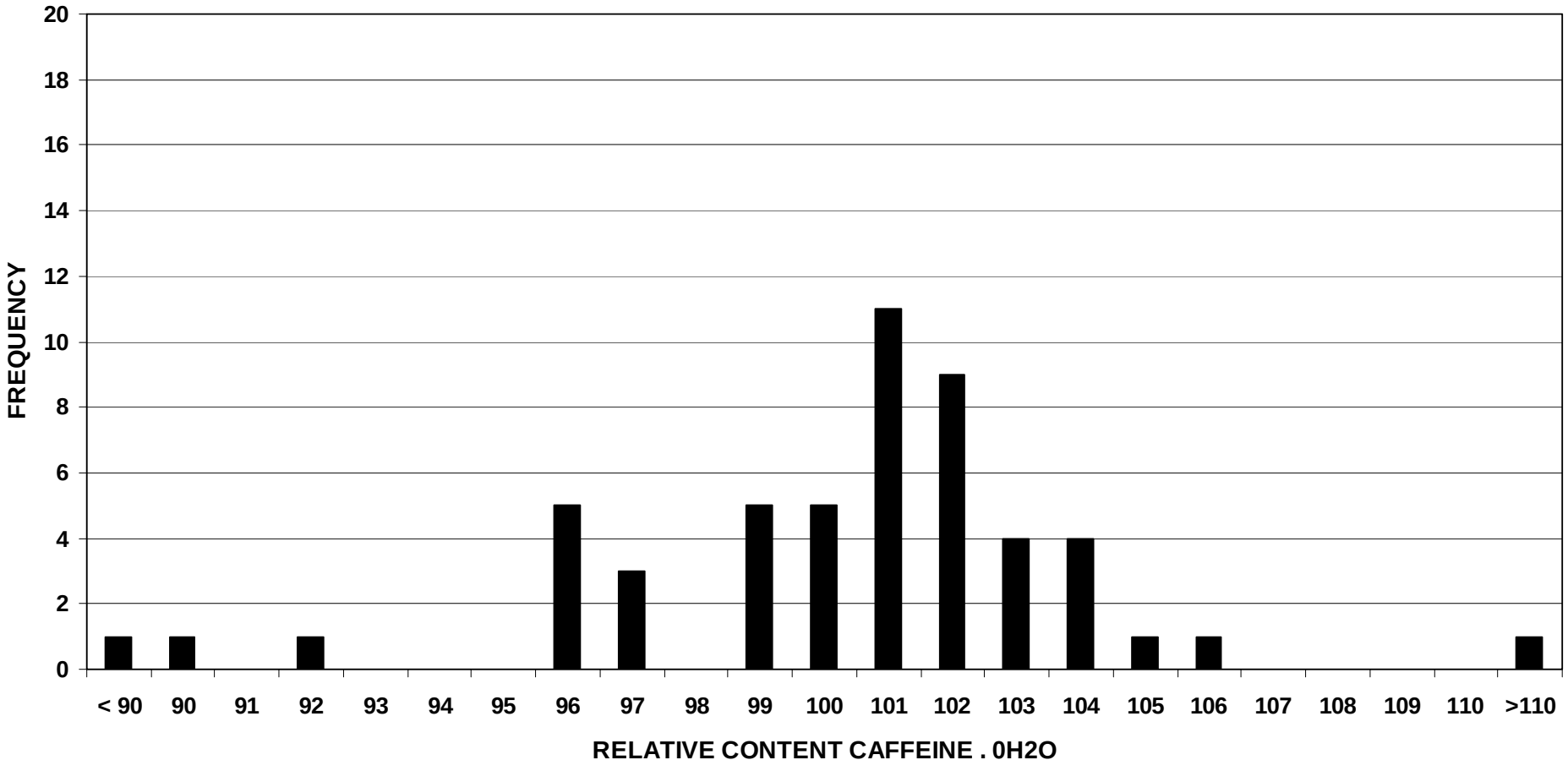
Sodium Thiosulphate Injection 250 mg/ml
FIP Proficiency Testing 2003



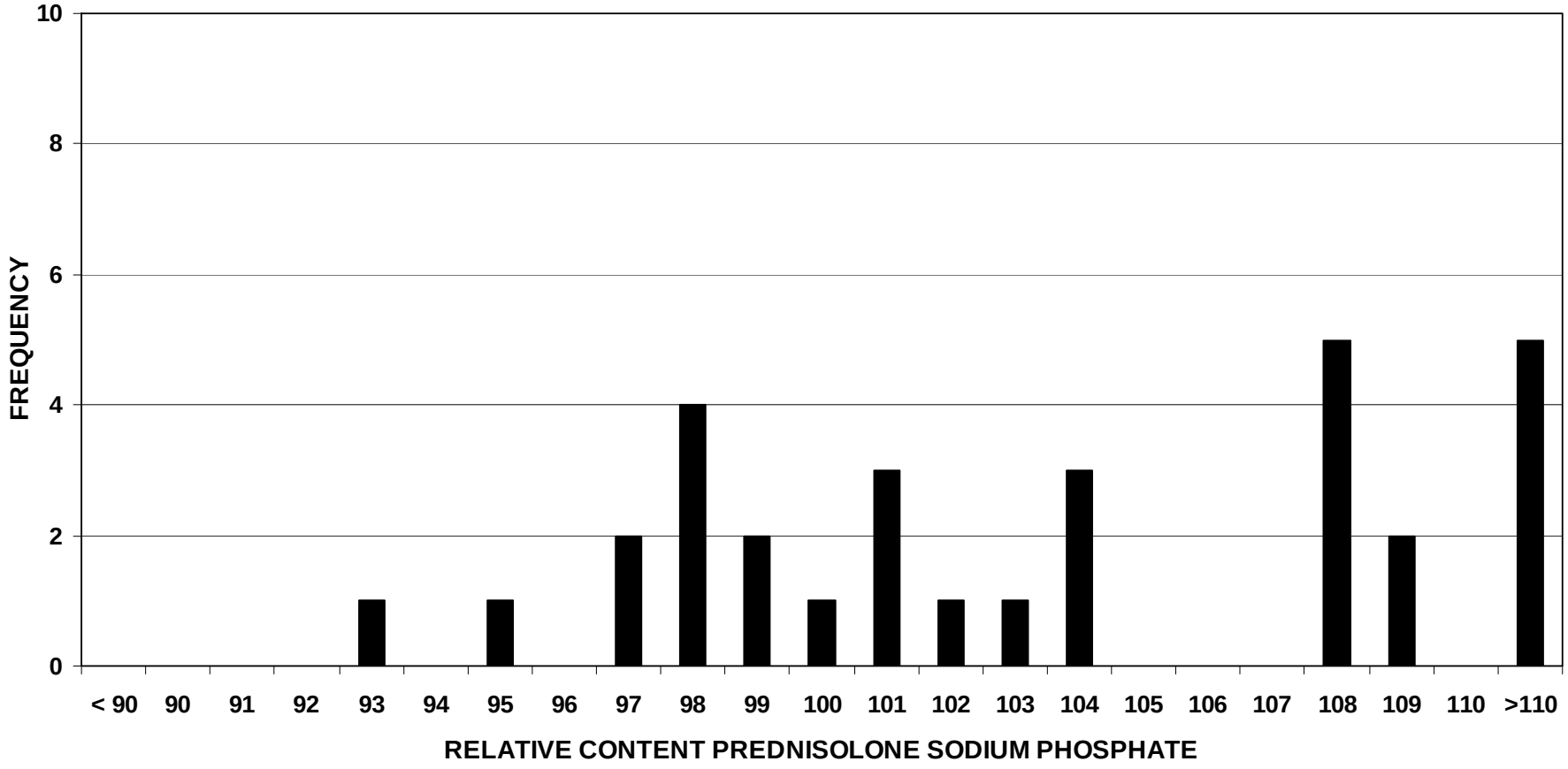
Isoniazid Injection 200 mg = 2 ml
FIP Proficiency Testing 2003



Caffeine Injection 10 mg/ml
FIP Proficiency Testing 2004



Prednisolone Sodium Phosphate Oral Solution 1.34 mg/ml FIP Proficiency Testing 2005



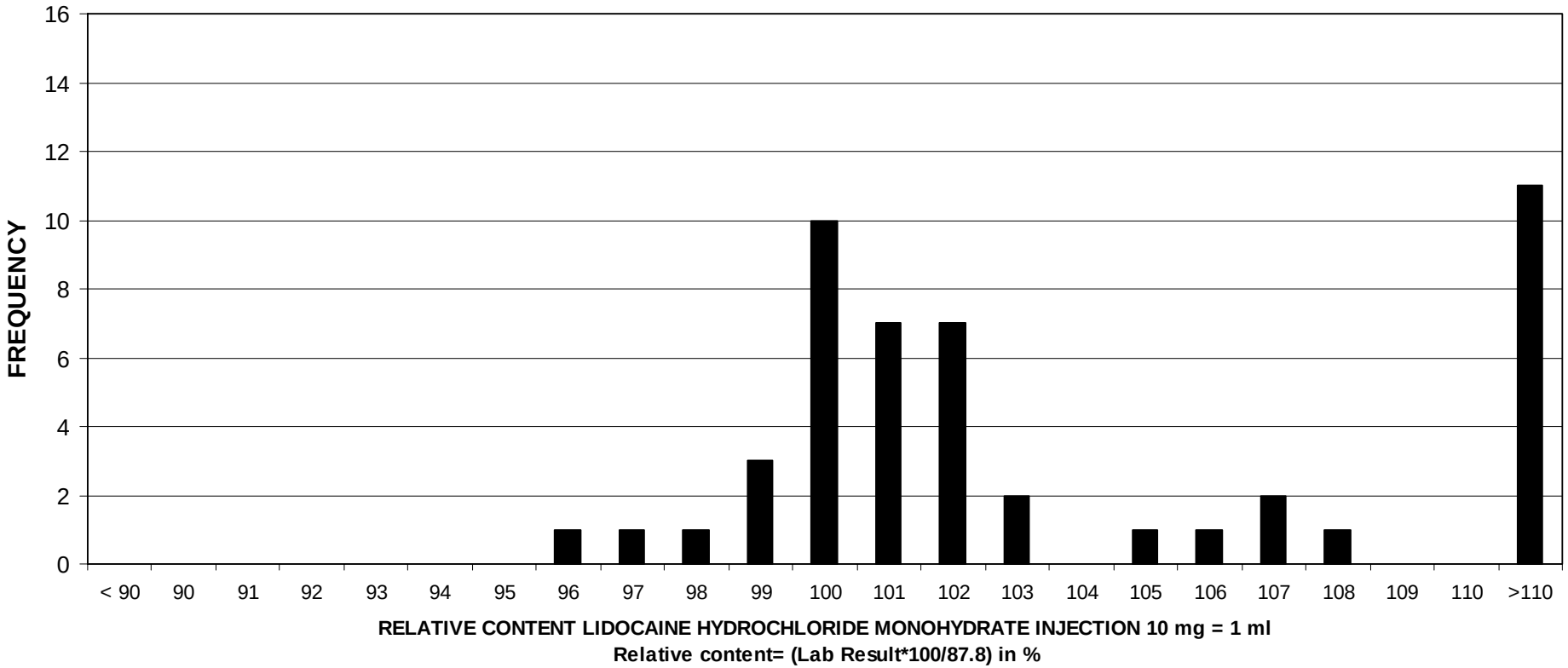
Composition Lidocaine Hydrochloride monohydrate Injection 10 mg = 1 ml

- Lidocaine Hydrochloride monohydrate 1 g
- Sodium Chloride 700 mg
- Sodium Hydroxide Solution 2 M 0.05 ml
- Water, purified sufficient to produce 100 ml

Frequency Methods
Lidocaine Hydrochloride monohydrate
Injection 10 mg = 1 ml

- 33 x H.P.L.C.
- 9 x Titration
- 4 x UV spectrophotometry
- 1 x T.L.C.
- 1 x no method mentioned

Lidocaine Hydrochloride monohydrate Injection 10 mg = 1 ml FIP Proficiency Testing 2006



Results FIP Labs
Lidocaine Hydrochloride monohydrate
Injection 10 mg = 1 ml

- Reference value : 87.8%
- Mean value (all participants) : 91.2% (n= 48)

- 33% of results were between 87.8% +/- 1.0%
- 56% of results were between 87.8% +/- 2.0%
- 65% of results were between 87.8% +/- 3.0%

HPLC: Possible sources of error

1. Weighing of samples and / or standards
2. Dilution errors
3. Precision of injection
4. Type and condition stationary phase
5. Mobile phase composition
6. Stability of solutions
7. Solution preparation
8. Choice of integration conditions

UV: Possible sources of error

1. Weighing of samples and / or standards
2. Dilution errors
3. Solution preparation
4. Stability of solution
5. Instrument performance
6. Use of appropriate slit-width
7. Measurement at wavelength of maximum absorbance or given wavelength

Titrimetry: Possible sources of error

1. Weighing errors
2. Clean-up step
3. Strength and volume of acid
4. Control of pH
5. Standardisation of the titrant
6. The end point of the titration

Summary results content testing

	number	✂1%	✂2%	✂3%	>3%
1999(s)	16	25%	69%	94%	6%
2000(z)	28	50%	71%	75%	25%
2000(t)	33	33%	58%	70%	30%
2001(l)	51	43%	55%	78%	22%
2001(p)	51	35%	63%	72%	28%
2002(m)	49	20%	51%	65%	35%
2002(s)	50	52%	72%	84%	16%

Summary results content testing

	number	≤1%	≤2%	≤3%	>3%
2003 (s)	44	61%	77%	82%	18%
2003 (i)	54	24%	65%	81%	19%
2004 (c)	52	23%	58%	60%	40%
2005 (p)	31	10%	32%	45%	55%
2006 (l)	48	33%	56%	65%	35%

Conclusions 8 rounds ptp 1999-2006

- pH testing : >10 is difficult
- Content testing : many methods are used
- Content testing : deviation ✂2% -> 32 - 77%