



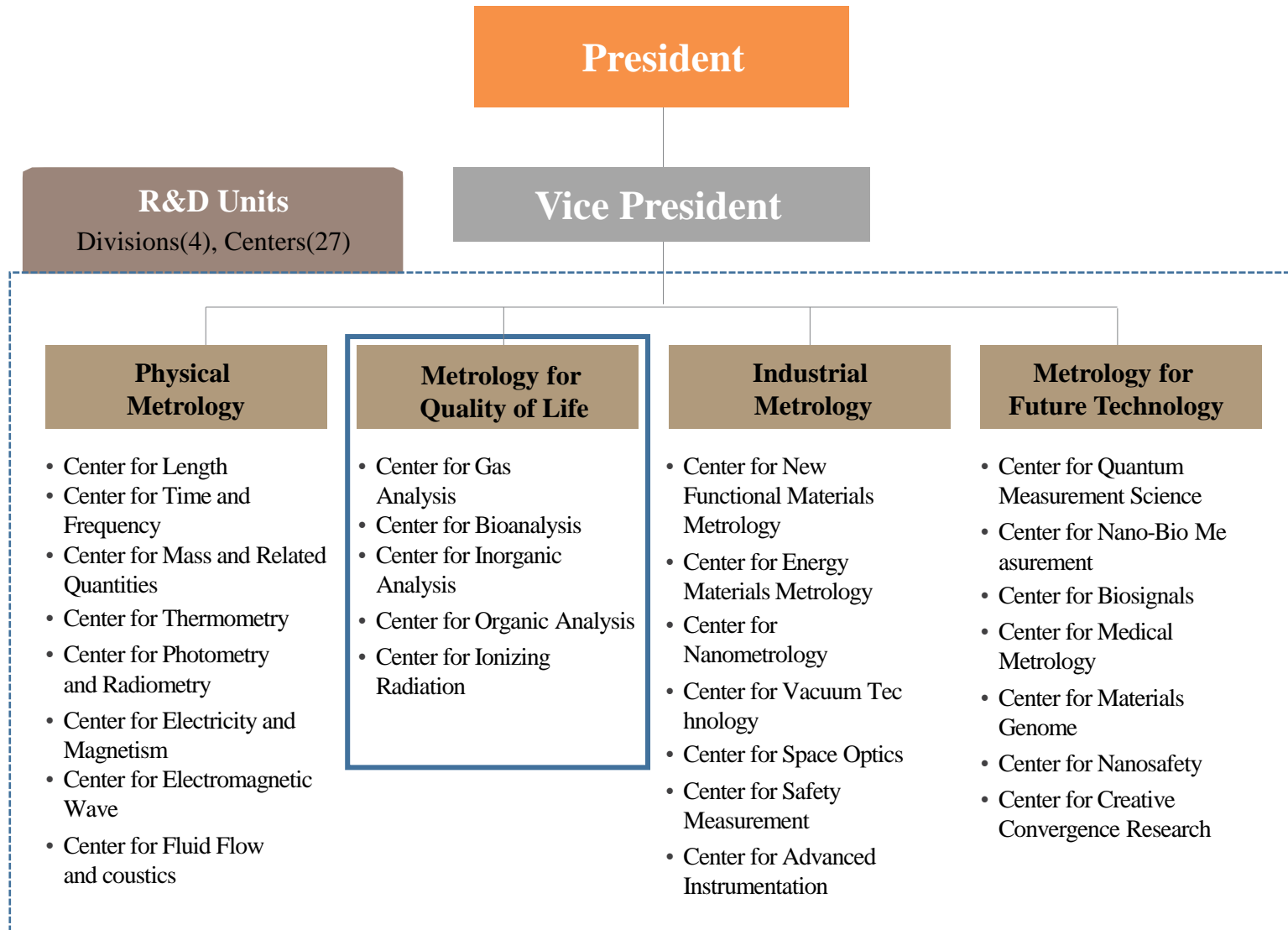
Developing Chemistry and Biology Metrology Programs in Korea

October 25th, 2016

Sang-Ryoul Park, Vice President of KRIS

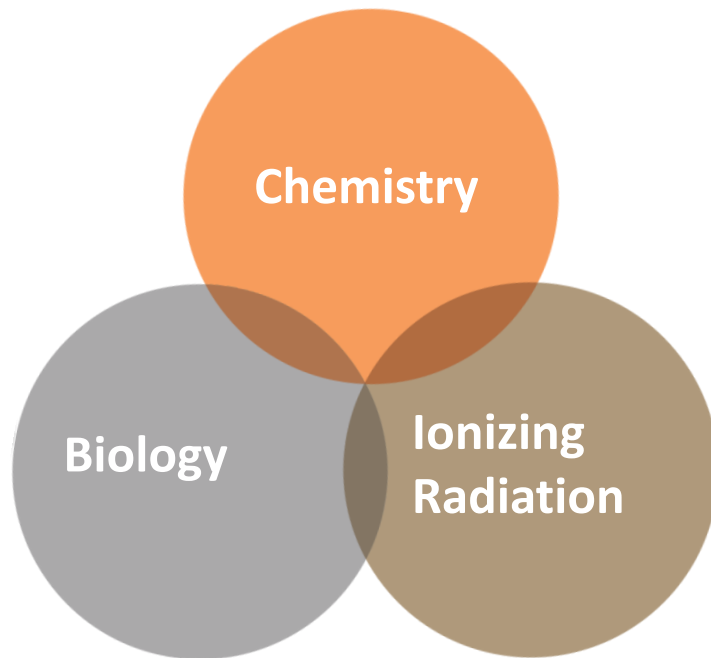


1. Division of Metrology for Quality of Life



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Division of Metrology for Quality of Life



FOOD

**Food
safety and quality**



ENVIRONMENT

**Environmental
protection**

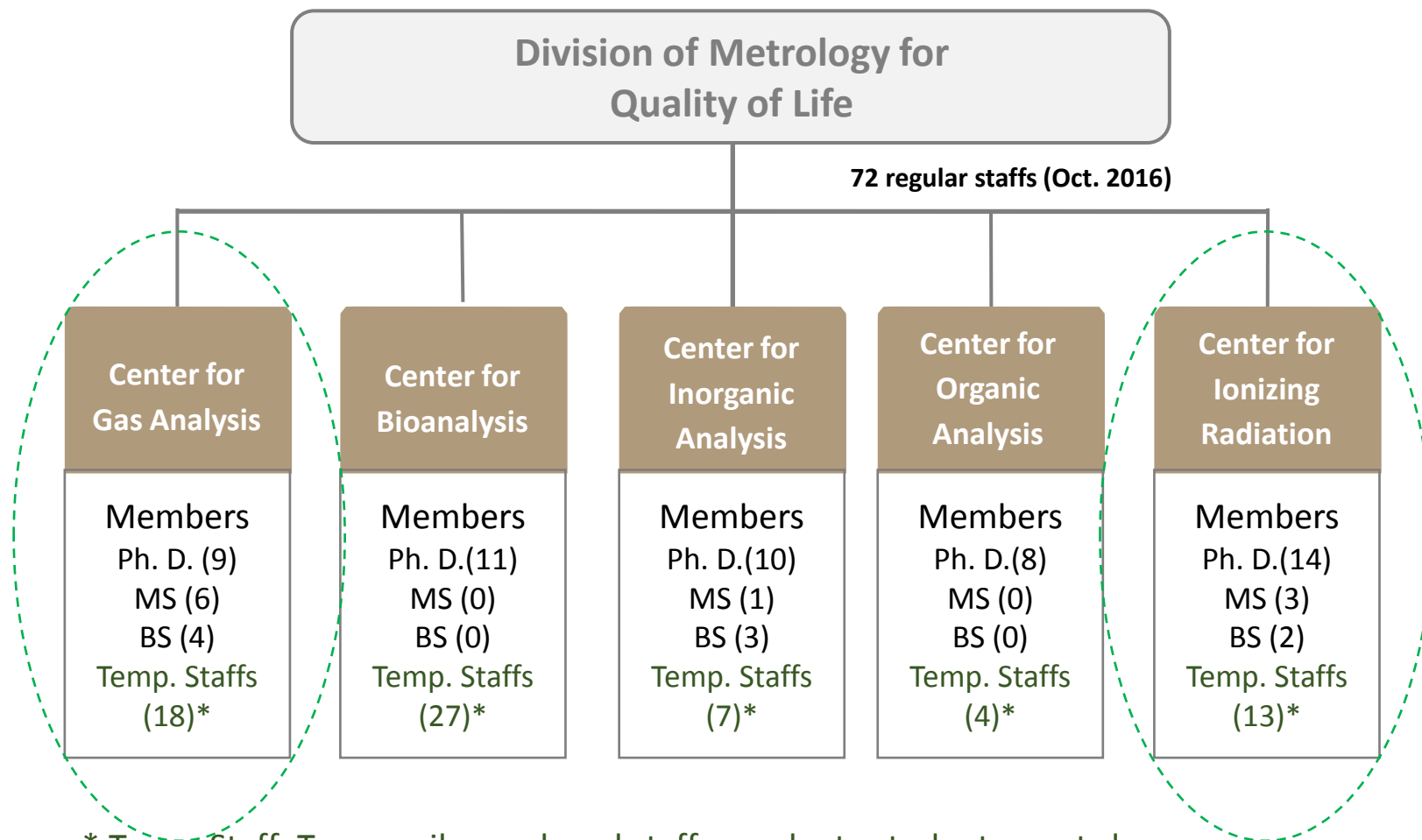


HEALTH

**Reliable
Medical Service**

Development, maintenance and dissemination of
National measurement standards to strengthen Quality of Life

1. Division of Metrology for Quality of Life



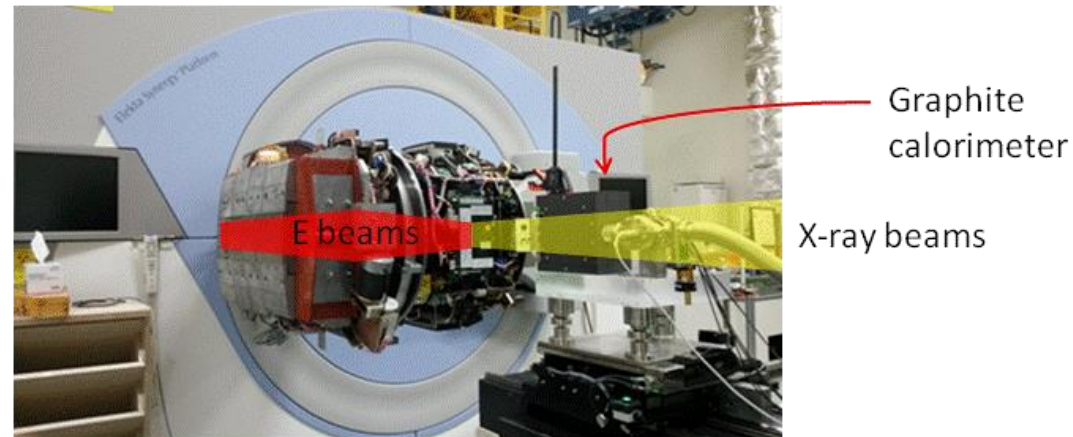
2. Metrology Programs for Ionizing Radiation

Center for Ionizing Radiation

- Legal enforcement of implementation of metrology
- Public awareness dramatically increased after Fukushima nuclear disaster
 - >> CRMs for surveillance of low level contaminations
- Ensuring safety in medical diagnostics and treatment using radioactive sources
 - >> calibration of LINAC and CT scanner, etc.



- Radioactivity measurement (Cs-137, K-40)
- SC Pilot : CCRI(II)-S9, 24 participants



KRISS medical linac & graphite calorimeter

3. Metrology Programs for Gas Analysis

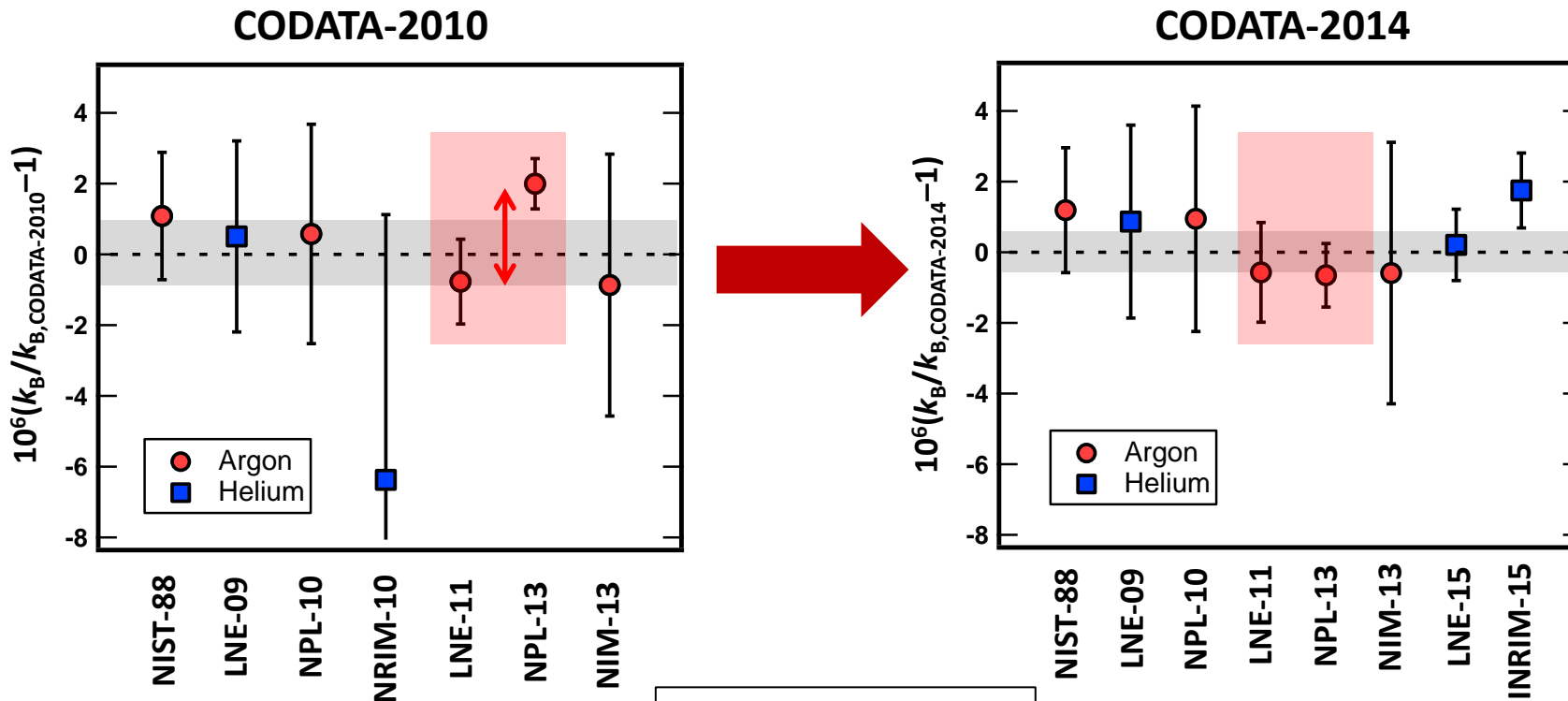
Center for Gas Analysis

- Exclusiveness in facility for standard gas preparation
- Long term investment in manpower and equipment
- Pursuit of In-depth R&D



3. Metrology Programs for Gas Analysis

Gas Metrology to CCT (Thermometry) (Redetermination of the Boltzmann constant)



$$k_B = \frac{c_0^2 M_{Ar}}{T \gamma_0 N_A}$$

Argon molar mass (M_{Ar}) determination by gas metrology

3. Metrology Programs for Gas Analysis

Gas Metrology to CCM (Mass) (Accurate measurement of air density)

$$\rho_a = \frac{pM_a}{ZRT} \left[1 - x_v \left(1 - \frac{M_v}{M_a} \right) \right]$$

ρ_a : air density

M_a : molar mass of dry air

Automatic weighing system*for accurately preparing primary standard gas mixtures

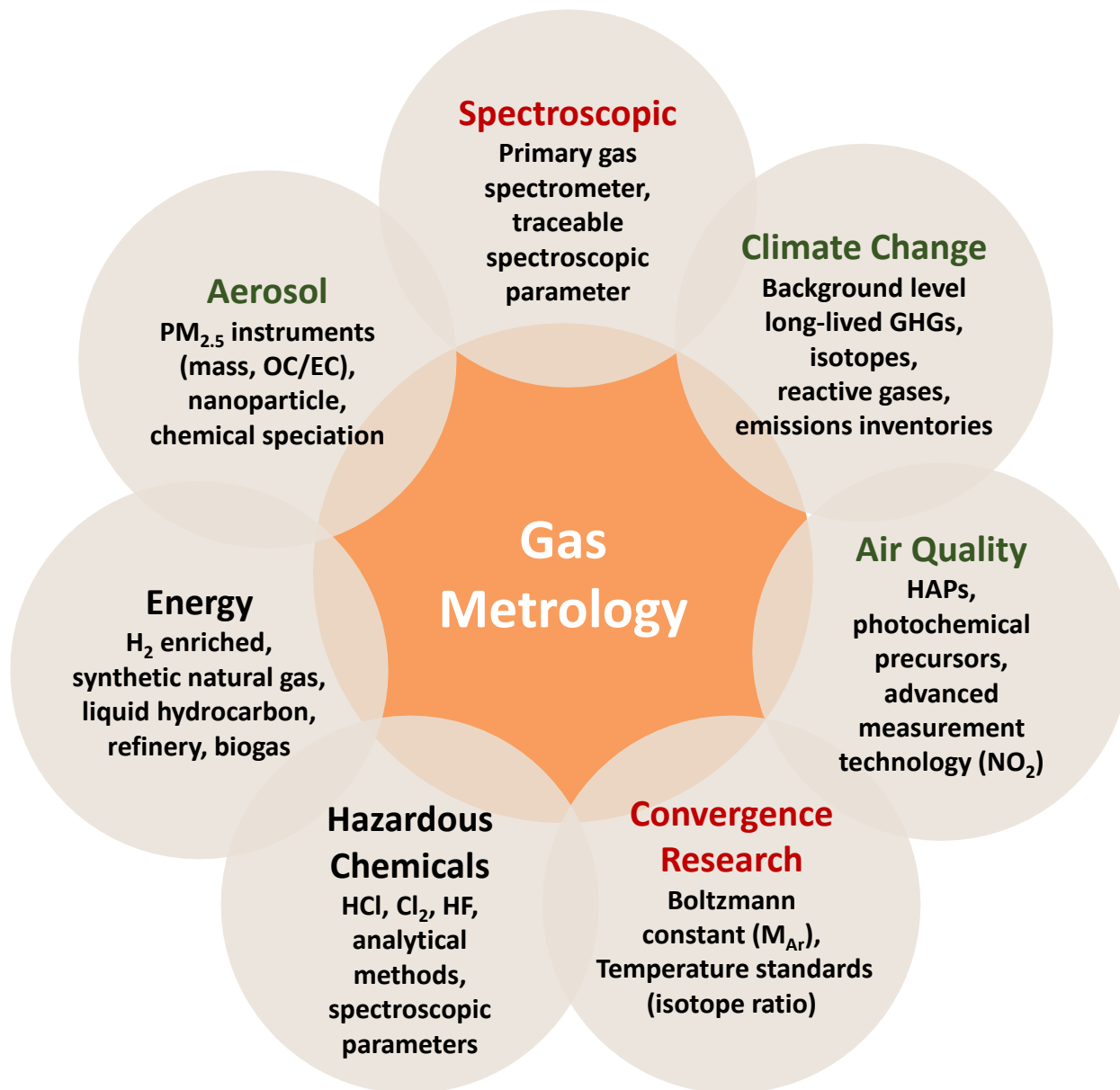


*sold to NIST, NPL, NIM, NMC

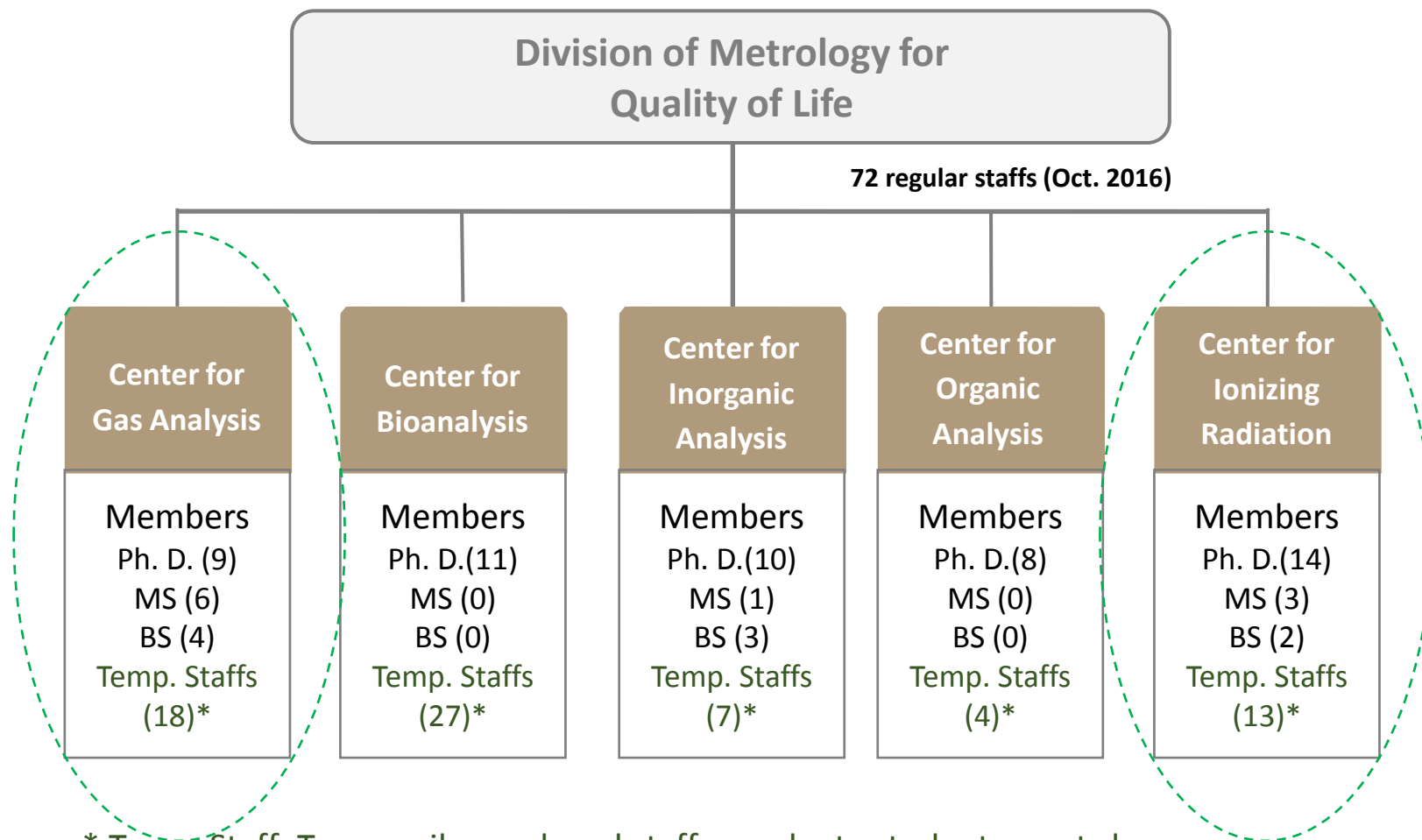
Redetermination of **Ar mole fraction** in Air

Constituents of dry air	Our results	P. Giacomo et al.*
N ₂	0.78082 ± 0.00012	0.78101
O ₂	0.20945 ± 0.00012	0.20939
Ar	0.009332 ± 0.000006	0.00917
CO ₂	0.000369 ± 0.000001	0.00040
The others	0.0000271 ± 0.0000030**	0.0000271

3. Metrology Programs for Gas Analysis



1. Division of Metrology for Quality of Life



4. Metrology Programs for Analytical Chemistry

Need for patient fostering of Chem-Bio metrology

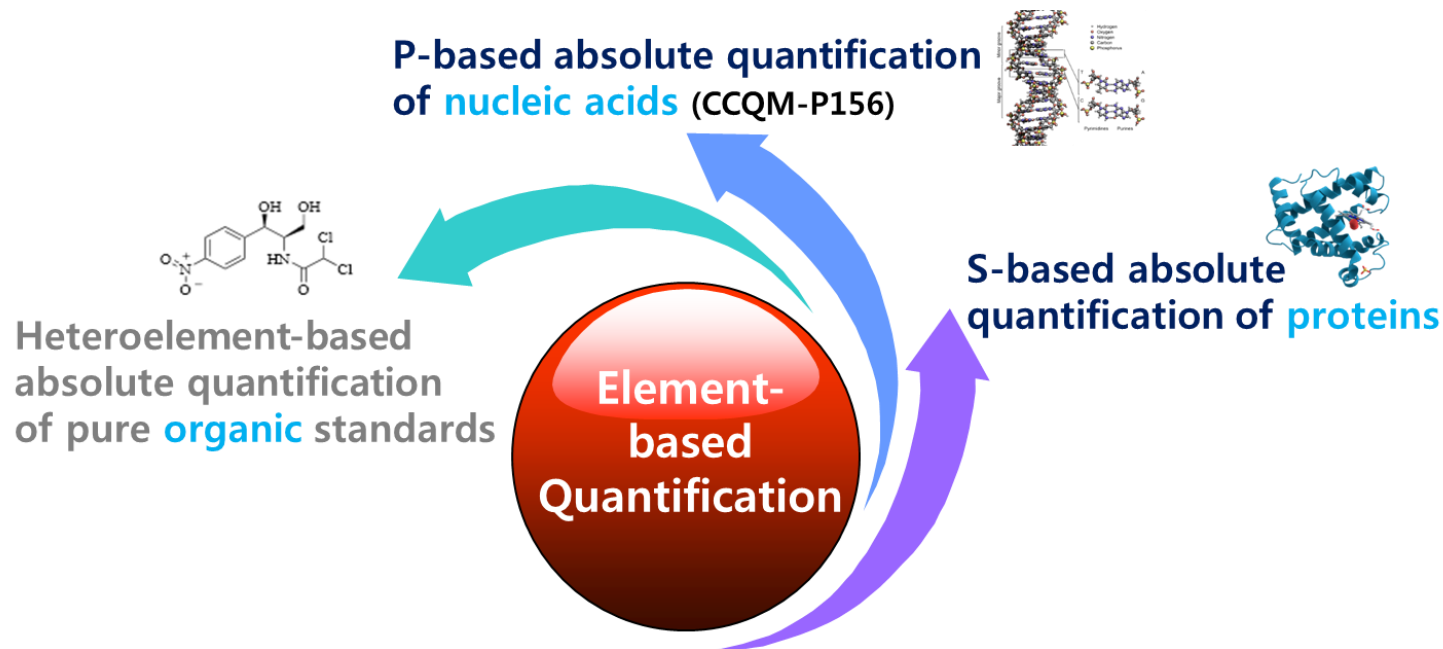
- Wrong-doings in measurement procedures not readily noticeable
- Regulatory bodies work with given authorities
- Easy to self-prepare calibration standards
- Difficulties in provision of comprehensive sets of CRMs



- Expectation of changes in wind directions
- Systematic investment for capacity building
- Advancement in efficiency and effectiveness in implementation of MiC
- Actively approaching to stakeholders (PT organization)

4. Metrology Programs for Analytical Chemistry

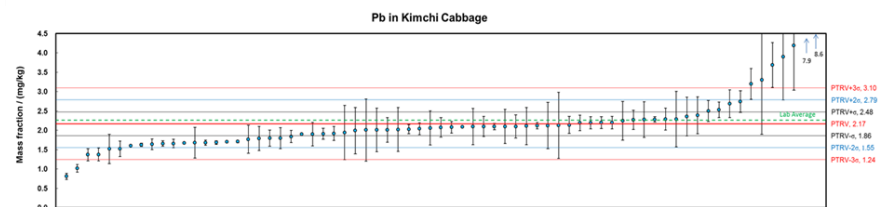
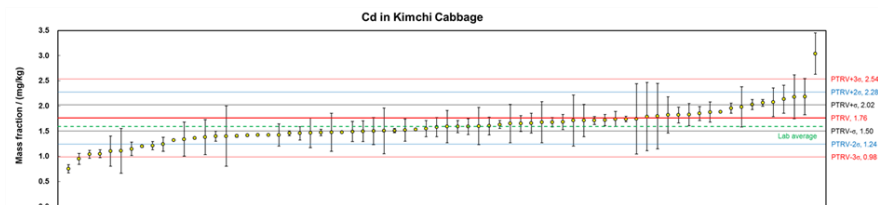
- **Keynote CRM strategy:** covering wider range of demands from stakeholders with smaller number of CRMs for food and environmental analysis
- **Shifting from bulk analysis to microscopic analysis**
- **Accurate elemental analysis in an ultra-trace level:** for high purity industrial materials
- **Element-based SI-traceable quantification:** establishing SI-traceability of bio- & organic pure standards using hetero-element quantification such as P, S, Se, Cl, Br, I and other metallic elements



4. Metrology Programs for Analytical Chemistry

APMP-APLAC Joint Proficiency Test

- Background
 - Collaboration of NMI & AB to provide traceability in PT organization
 - NMIs/Dis coordinate PTs & provide **homogenous & stable samples** with **certified reference value (RV)** as the PTRV: RV based on registered CMCs
- Outcomes
 - APMP-APLAC PT T93: Cd & Pb in cabbage (2014-2015, 83 participants)
 - PT T94: *p,p'*-DDE & α -endosulfan in cabbage (2014-15, 70 participants)
 - PT T100: Cd & Pb in wheat flour (2015-16, 95 participants)
 - PT T105: Fe & Zn in wheat flour (2016-17, in progress)



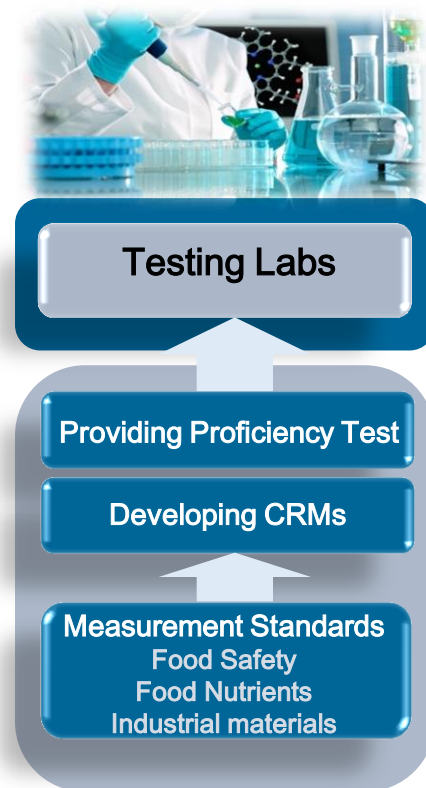
4. Metrology Programs for Analytical Chemistry

Establishing/disseminating national measurement standards to ensure measurement reliability in the areas of

- Food safety, food nutrients
- Pharmaceutical products
- Industrial materials (related with regulation of hazardous substances such as brominated flame retardants, phthalates, etc)

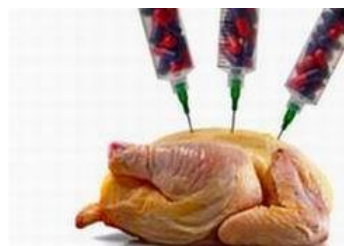
Nutrient Metrology Program(2014-2018, 5-yr)

- Cooperation program between 3 centers (Organic, Inorganic, Bioanalysis)
- Food nutrients
- Nutritional biomarkers in clinical samples



4. Metrology Programs for Analytical Chemistry

Recent Achievements



Infant formula CRMs for the analysis of nutrients
[KRISS CRM No. 108-02-003: Organic Nutrients]
[KRISS CRM No. 108-02-004: Inorganic Nutrients]

Food CRMs for the analysis of veterinary drug residues
[KRISS CRM No. 108-03-003: Enrofloxacin in chicken meats]
[KRISS CRM No. 108-03-004: Ciprofloxacin in Chicken meats]
[KRISS CRM No. 108-02-005: Chloramphenicol infant formula]



Food CRMs for the analysis of Mycotoxins
[KRISS CRM No. 108-02-003: Ochratoxin A in Fermented soybean paste]
[KRISS CRM No. 108-05-008: Patulin in apple juice]

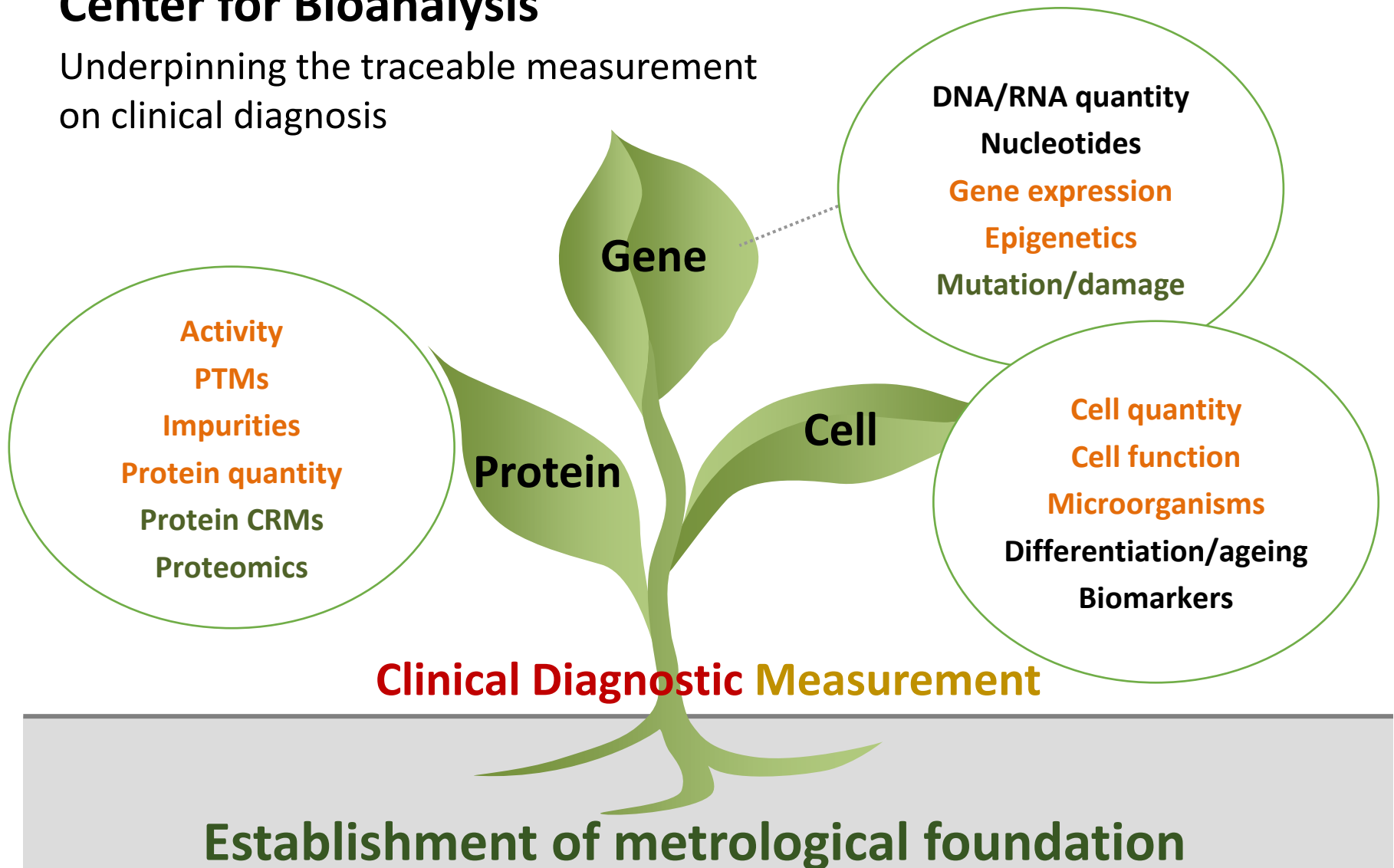
On-going Activities

- CRMs for nutrients in food supplements, grains, vegetables/ fruits, meats, and fishery products
- CRMs for mycotoxins, veterinary drugs, pesticides, and hazardous elements in food

5. Bio Analysis Research Programs

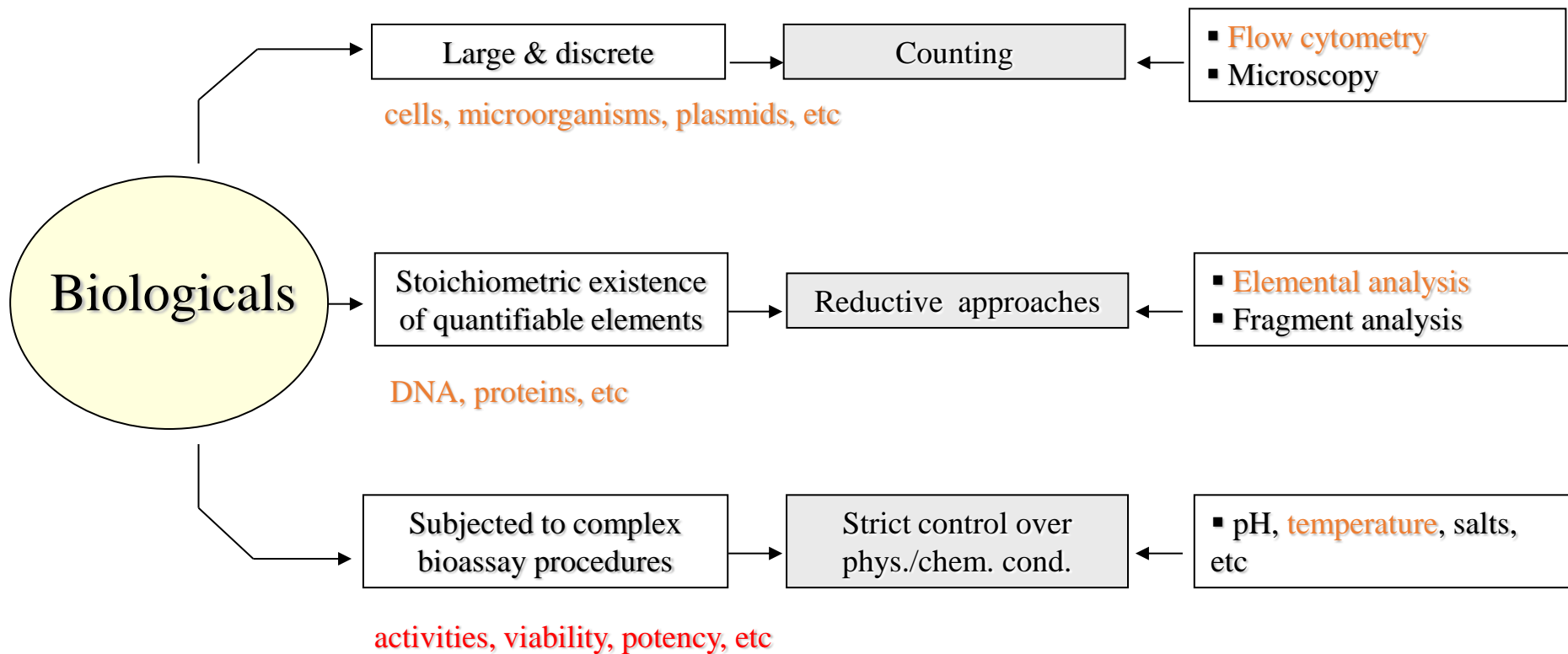
Center for Bioanalysis

Underpinning the traceable measurement on clinical diagnosis



5. Bio Analysis Research Programs

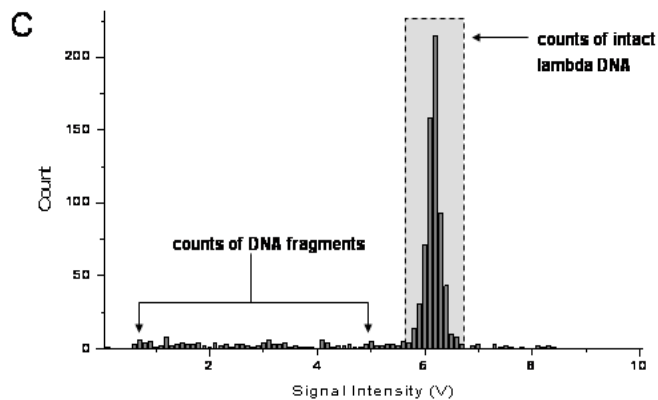
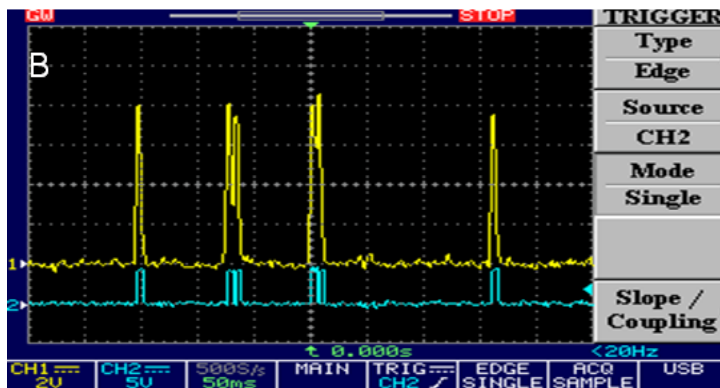
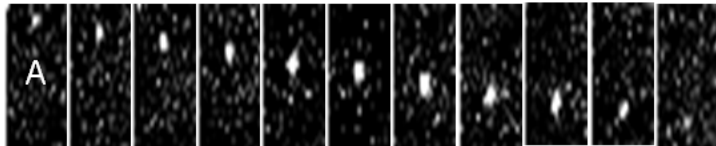
KRISS' approaches to establish metrology for biology



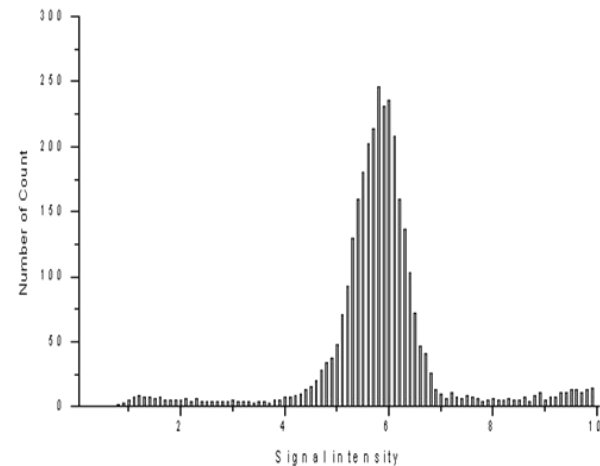
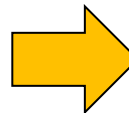
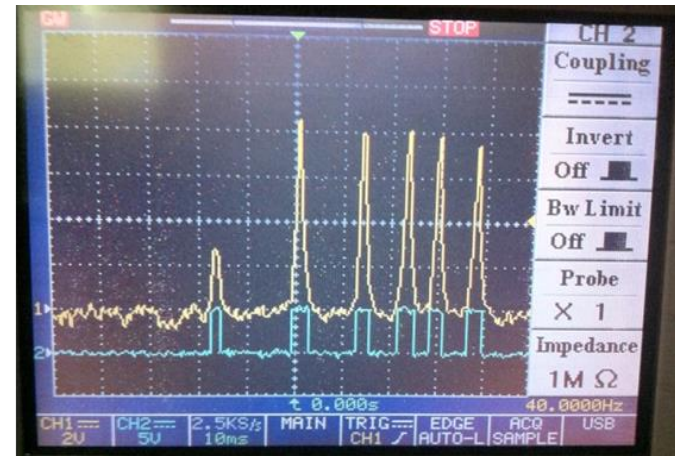
5. Bio Analysis Research Programs

“Exhaustive” Direct Counting

Lambda phage DNA (45.8 kbp)



pBR322 plasmid DNA (4.31 kbp)



Summary

- Division of Metrology for Quality of Life in KRISS consists of 5 centers of Ionizing Radiation, Gas Analysis, Inorganic Analysis, Organic Analysis, and Bio Analysis.
- Ionizing Radiation and Gas Analysis has settled down at its early stage in dissemination of measurement standards.
- Organic and Inorganic Analysis have struggled in finding the right mechanism for effective dissemination.
- Along with the advancement of CCQM, KRISS MiC programs has been grown to fully engage in real world measurement problems as the society acknowledges its necessity.
- KRISS Bio metrology program has established the metrological basis for biomeasurement and looks forward to implementing in clinical diagnostics.

*Better Standards,
Better Life*

Thank you !

