

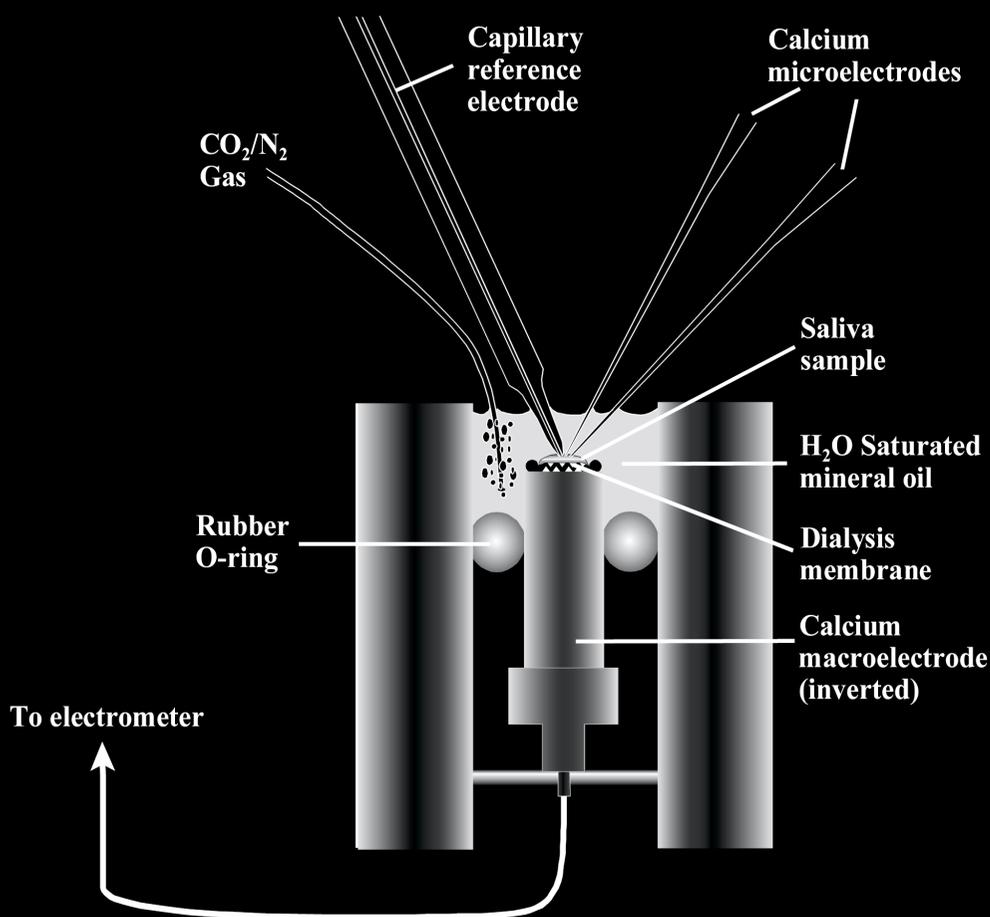
# Journal of Research

of the



# National Institute of Standards and Technology

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**NIST**

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Technology Administration, U.S. Department of Commerce

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**T**he National Institute of Standards and Technology was established in 1988 by Congress to “assist industry in the development of technology . . . needed to improve product quality, to modernize manufacturing processes, to ensure product reliability . . . and to facilitate rapid commercialization . . . of products based on new scientific discoveries.”

NIST, originally founded as the National Bureau of Standards in 1901, works to strengthen U.S. industry’s competitiveness; advance science and engineering; and improve public health, safety, and the environment. One of the agency’s basic functions is to develop, maintain, and retain custody of the national standards of measurement, and provide the means and methods for comparing standards used in science, engineering, manufacturing, commerce, industry, and education with the standards adopted or recognized by the Federal Government.

As an agency of the U.S. Commerce Department’s Technology Administration, NIST conducts basic and applied research in the physical sciences and engineering, and develops measurement techniques, test methods, standards, and related services. The Institute does generic and precompetitive work on new and advanced technologies. NIST’s research facilities are located at Gaithersburg, MD 20899, and at Boulder, CO 80303. Major technical operating units and their principal activities are listed below. For more information contact the Publications and Program Inquiries Desk, 301-975-3058.

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- International and Academic Affairs

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- Technology Partnerships
- Measurement Services
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- Program Development

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- Law Enforcement Standards
- Electricity
- Semiconductor Electronics
- Radio-Frequency Technology<sup>1</sup>
- Electromagnetic Technology<sup>1</sup>
- Optoelectronics<sup>1</sup>

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- Ceramics
- Materials Reliability<sup>1</sup>
- Polymers
- Metallurgy
- NIST Center for Neutron Research

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- Optical Technology
- Ionizing Radiation
- Time and Frequency<sup>1</sup>
- Quantum Physics<sup>1</sup>

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- Fire Science

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- Advanced Network Technologies
- Computer Security
- Information Access and User Interfaces
- High Performance Systems and Services
- Distributed Computing and Information Services
- Software Diagnostics and Conformance Testing
- Statistical Engineering

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<sup>1</sup>At Boulder, CO 80303.

<sup>2</sup>Some elements at Boulder, CO.

# *Journal of Research of the* **National Institute of Standards and Technology**

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Volume 105

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March–April 2000

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**Cover:** The cover illustration is a diagram of the apparatus used to compare the ion selective response for liquid calcium-ion exchangers as described in the article authored by Carey and Vogel, page 267. Two calcium ion-selective microelectrodes and one inverted macroelectrode were used with a capillary reference electrode to measure the calcium activity of a sample simultaneously.

The *Journal of Research of the National Institute of Standards and Technology*, the flagship periodic publication of the national metrology institute of the United States, features advances in metrology and related fields of physical science, engineering, applied mathematics, statistics, and information technology that reflect the scientific and technical programs of the Institute. The *Journal* publishes papers on instrumentation for making accurate measurements, mathematical models of physical phenomena, including computational models, critical data, calibration techniques, well-characterized reference materials, and quality assurance programs that report the results of current NIST work in these areas. Occasionally, a Special Issue of the *Journal* is devoted to papers on a single topic. Also appearing on occasion are review articles and reports on conferences and workshops sponsored in whole or in part by NIST.

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## *Message From the Chief Editor*

Dear Reader,

The National Institute of Standards and Technology (NIST) was founded as the National Bureau of Standards (NBS) on March 3, 1901 by the 56th Congress of the United States (Public Law 177). Thus NIST will be 100 years old in less than 10 months. In honor of this historic occasion, a number of special NIST Centennial events will be held throughout 2001, but especially during the 5 day period beginning Monday, March 5, 2001. In further commemoration of NIST's centennial, the *Journal of Research of the National Institute of Standards and Technology* will publish its January-February issue of 2001 (Volume 106, Number 1) as a Special Issue with the title "NIST: 100 Years of Measurement." Current plans call for about a dozen or more articles, many of which will revolve around the base units of the International System of Units (SI): the meter, kilogram, second, ampere, kelvin, mole, and candela.

Also in recognition of NIST's Centennial, starting with this issue, we will reprint a "Treasure of the Past"—an article published in the last 100 years in the *Journal* or one of its predecessors. There will be 10 articles in 10 different issues, with each article chosen sequentially from each decade of NIST's existence. They will be selected so as to reflect the character of the work carried out in this unique institution during the past 100 years and the unmatched breadth and excellence of that work.

The first article to be reprinted appears in this issue starting on page 307 and is entitled "Recomparison of the United States Prototype Meter," by L. A. Fischer. This was the first article in the first issue of the *Bulletin of the National Bureau of Standards*, the first embodiment of the current *Journal*. The *Bulletin*, published as Volumes 1-14, 1904-1918, was replaced by *Scientific Papers of the Bureau of Standards*, Volumes 15-22, 1919-1928, which was then replaced by *Bureau of Standards Journal of Research*, Volumes 1-12, 1928-1934. The latter was followed by the *Journal of Research of the National Bureau of Standards*, Volumes 13-92 (plus Issues 1-5 of Volume 93), 1934-1988. The first full volume published under the title *Journal of Research of the National Institute of Standards and Technology* was Volume 94 in 1989.

NBS became NIST on August 23, 1988, when President Reagan signed the Omnibus Trade and Competitiveness Act. Although NIST was founded as NBS in 1901, when NBS was transferred in 1903 from the Treasury Department, its initial home, to the new Department of Commerce and Labor, the word "National" was eliminated from the name by the head of the Department because it was thought that the word "National" was inconsistent with the names of similar bureaus in the Department. In 1934, some 30 years later, the original NBS name was restored because of the proliferation of "Bureaus of Standards" in State governments and private organizations.

We hope that you find the "Treasure of the Past" included in this issue to be of interest, as well as those to be reprinted in future issues.

**Barry N. Taylor**  
Chief Editor

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