NIST-FDA Cell Counting Workshop: Sharing practices in cell counting measurements

NIST Organizers:
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Sumona Sarkar
Clare Allocca

FDA Organizers:
Judith A. Arcidiacono
Steven S. Oh
Steve Bauer

Meeting Logistics

Safety

Lunch and coffee (NIST cafeteria)

Group dinner (on your own)

Meeting presentation/discussion format

Permission to post of meeting materials

“Idea box” for live entry of comments/ideas during session 4

Acknowledgements

NIST-FDA Cell Counting Workshop: Sharing practices in cell counting measurements

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Chair, US TAG to ISO/TC276 Biotechnology
Convenor, WG3 Analytical Methods, ISO/TC 276 Biotechnology

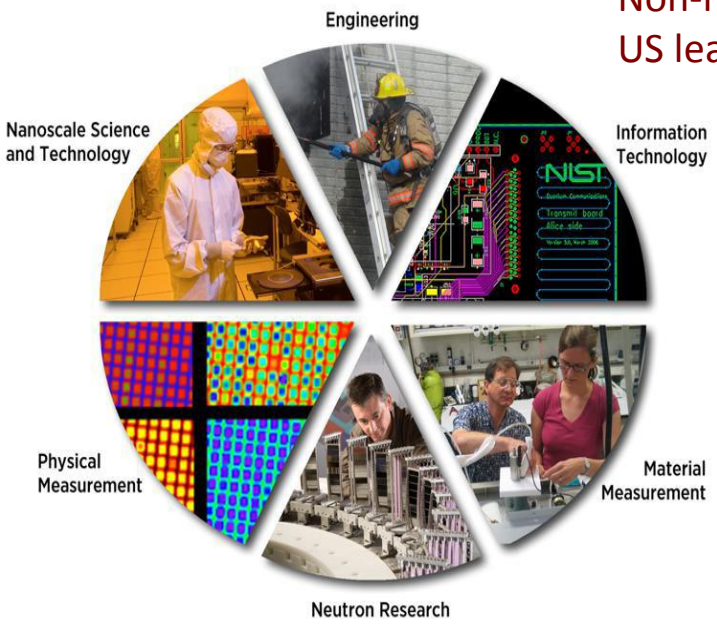
NIST – Who we are today

The National Metrology Institute

global harmonization of measurement and traceability to the SI

"Industry's National Laboratory"

Non-regulatory agency partnering/serving industry to help maintain US leadership in science and technology products

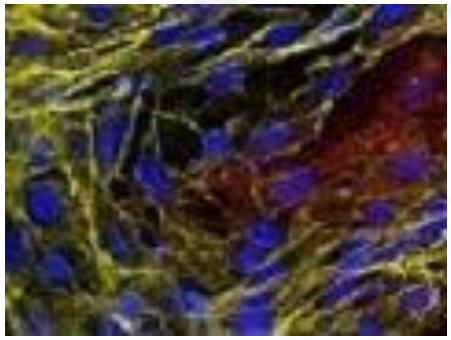


Department of Commerce

developing standards to support international trade and commerce

Bio at NIST

Develop measurement science, standards, data & technology to support development, manufacturing, & regulatory approval of biologics (proteins, cell-based therapeutics products, gene therapy products) and devices



- Works closely with stakeholders (biopharma industry, FDA, equipment vendors) to identify key measurement problems and solutions
- Draws from a broad array of unique, cutting-edge expertise, resources, and facilities available at NIST
- Is a scientifically trusted, impartial 3rd party that works to promote cross-industry collaboration & open data sharing

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

NIST Practices

Measurements and Technology

- Develop advanced measurement capabilities
- Improve measurement quality and assurance

Reference Materials /Standards

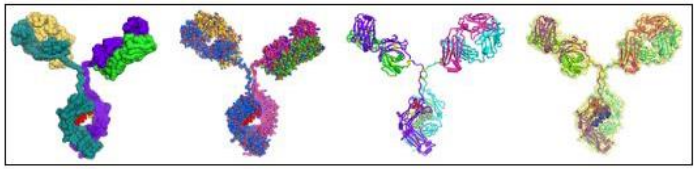
- Develop and certify NIST SRMs and RMs
- Generate reference data (e.g., chemical spectra)

Standards

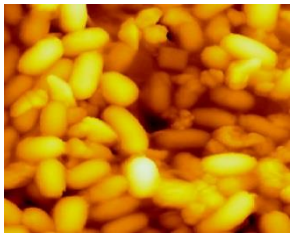
- Lead and contribute to documentary standards development through SDOs (e.g., ISO, IEC, ASTM, etc.)
- Conformity assessment
- Standards education

U.S. national prototype kilogram

NIST synthetic RNA controls used in sequencing of Ebola virus genomes

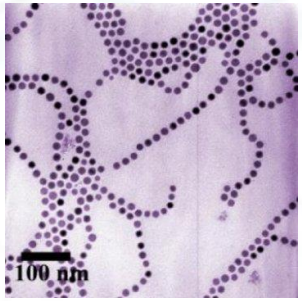


NIST Monoclonal Antibody Reference Material 8671



Yeast Cells as a Reference Material

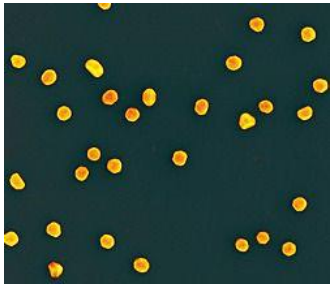
Counting Measurements at NIST



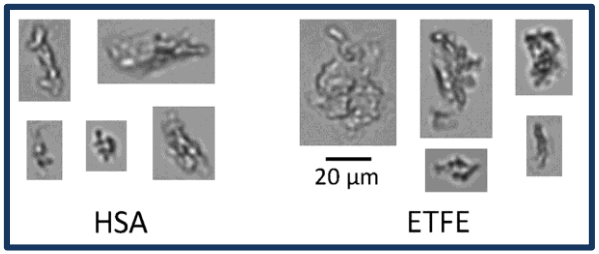
Co nanoparticles for medical imaging and information storage

Bacteria (s. mutans)

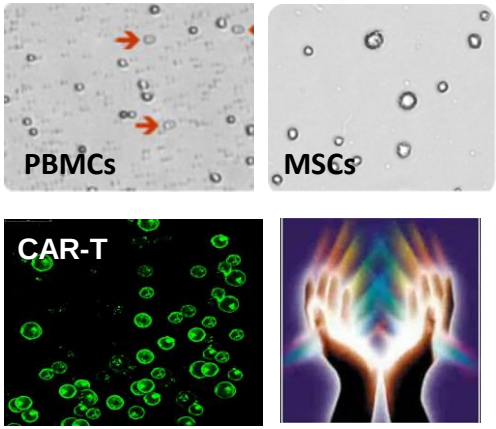
Gene modified yeast RM as a surrogate biothreat detection material



SEM of gold nanoparticles as RM in biomedical research laboratories.

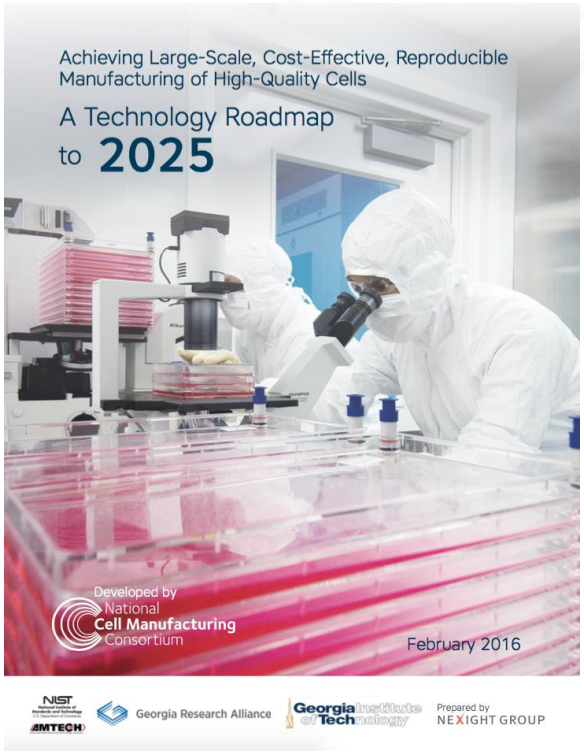


Polymeric RM mimicking the structure and characteristics of protein aggregates



Human cells for therapeutic/medicine use

NIST/AMTech funded industry-driven technology consortia that establishes technology roadmaps to address long-term U.S. industrial research needs.



DEVELOP AND IMPLEMENT ADVANCED TECHNOLOGIES AND TECHNIQUES

Cell Processing

- Screening and Selection Methods
- Culture Media Advances
- Cell Expansion Equipment
- Cell Expansion, Modification, and Differentiation Methods
- Separation Techniques

Cell Preservation, Distribution, and Handling

- Storage Infrastructure
- Product Tracking Systems
- Advanced Cryopreservation Technologies
- Alternative Preservation Technologies

Process Monitoring and Quality Control

- Monitoring and Feedback Control Technologies
- Cell Attribute Testing and Measurement Technologies
- Data Analytics
- Data Management
- Bioprocess Models

STRENGTHEN THE INDUSTRY FOUNDATION

Standardization and Regulatory Support

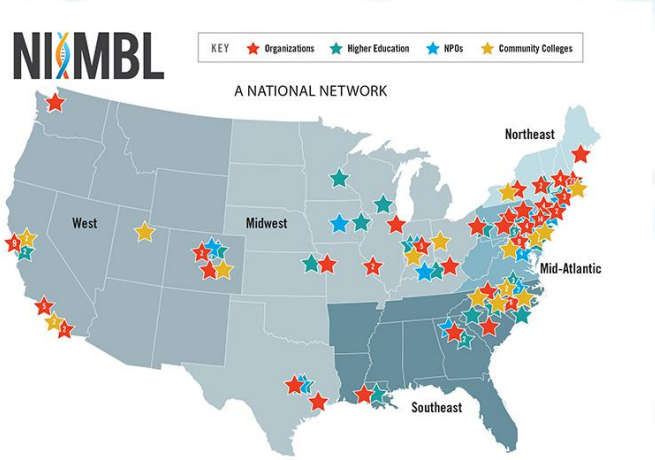
- Regulatory Strategy Development
- Supply Chain Consistency
- Product Quality Standards

Workforce Development

- Higher Education
- Workforce Training
- Cross-Industry Collaboration

LARGE-SCALE, COST-EFFECTIVE, REPRODUCIBLE MANUFACTURING OF HIGH-QUALITY CELLS

Dec 16, 2016: U.S. Secretary of Commerce Penny Pritzker Announces Biopharmaceutical Manufacturing Institute Joining Manufacturing USA Network

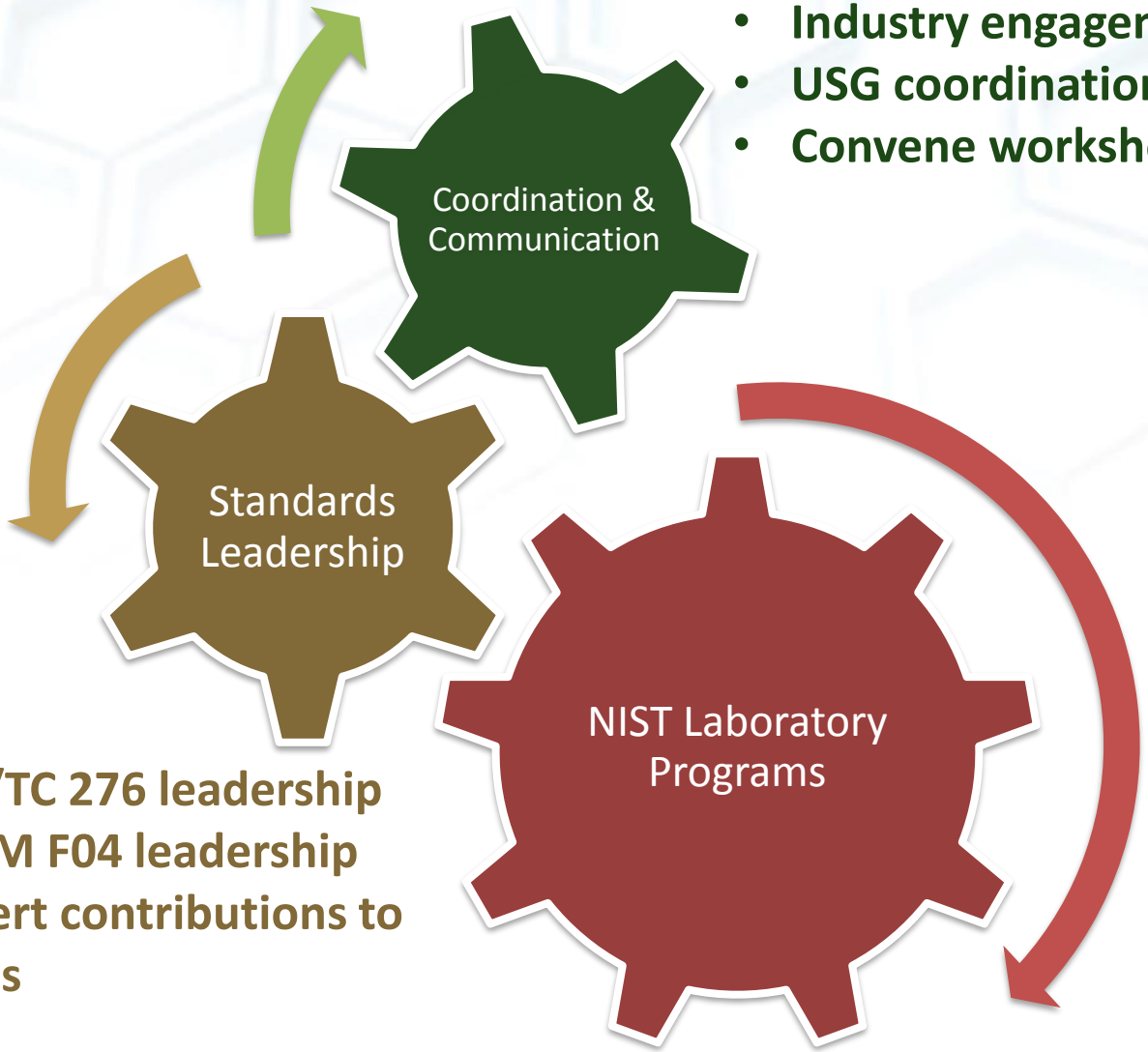


NIIMBL

AMERICAN INNOVATION AT WORK

The **NIIMBL mission** is to accelerate biopharmaceutical manufacturing innovation, support the development of standards that enable more efficient and rapid manufacturing capabilities, and educate and train a world-leading biopharmaceutical manufacturing workforce, fundamentally advancing U.S. competitiveness in this industry.

NIST Efforts in Cell-Based Medicinal Products



- **Industry engagement**
- **USG coordination**
- **Convene workshops**

- **ISO/TC 276 leadership**
- **ASTM F04 leadership**
- **Expert contributions to SDOs**

- **Innovative measurement solutions**
- **Industry collaborations**

Bridging the Communication Gap

NIST Meetings, Workshops, and Commentaries

Oct 25, 2017	NIST-FDA Flow Cytometry Workshop	tbd
April 2017	NIST-FDA Cell Counting Workshop	Whitepaper expected
July 2016	*Cytotherapy* Commentary: "Defining quality attributes to enable measurement assurance for cell therapy products"	Sheng Lin-Gibson and Sumona Sarkar et al., *Cytotherapy*, Volume 18 (10), October 2016, Pages 1241-1244
May 2016	Genome Editing Standards Workshop	http://www.nist.gov/mml/bbd/genes.cfm
Feb 2016	NIST CAR-T Biomanufacturing Symposium	Lin-Gibson et al. DOI: 10.1089/humc.2016.29014.com https://www.ibbr.umd.edu/NISTCART
May 2015	NIST Workshop: Strategies to Achieve Measurement Assurance for Cell Therapy Products	Simon et al. Stem Cells Translational Medicine 5, 705-708. http://www.nist.gov/mml/bbd/biomaterials/measurement-assurance-for-cell-therapy-products.cfm

NIST Participation/Contribution

Forum on Regenerative Medicine

The National Academies of SCIENCES · ENGINEERING · MEDICINE

MATES -
Multi-Agency Tissue Engineering Science

ISO

IABS

STANDARDS COORDINATING BODY

FDA-NIST Collaborations on Standards

Leveraging unique expertise

NIST engages in discussions and collaborates with industry and others on pre-competitive technologies

NIST expertise in measurement sciences address specific analytical challenges

FDA scientific and regulatory expertise ensure that standards

- do not conflict with FDA regulation and policy

- address significant regulatory challenges that recur across the field

Arcidiacono, Lin-Gibson, et al. Cytotherapy. Submitted

ISO/TC 276: Biotechnology*

Secretariat: DIN

Secretary: Lena Krieger

Chairperson: Ricardo Gent

27 participating countries

13 observing countries

- Terms and Definition
- Biobanking and Bioresources
- Analytical Methods
- Bioprocessing
- Data Processing and Integration

The ISO/TC 276/WG 3 Analytical methods aims to develop standards for accurate, reproducible and robust measurement and analysis in support of biotechnology.

- ISO/WD 20391-1&2: Biotechnology - **Cell Counting – Part 1. General Guidance on Cell Counting Methods**
- ISO/WD 20391-1&2: Biotechnology - **Cell Counting – Part 2. Experimental Design and Statistical Analysis to Quantify Counting Method Performance**
- **Characterization of Cells**
- ISO/AWI 20395 Quality considerations for targeted nucleic acid quantification methods
- ISO/AWI 20688, Biotechnology –Nucleic acid synthesis – General definitions and requirements for the production and quality control of synthetic nucleic acids.
- ISO/PWI 20397: Methods to evaluate the quality of massive sequencing data

2-day US TAG meetings to immediately follow this workshop

US TAG to ISO/TC276 Biotechnology

Providing a US voice on global biotech standards

Current status of the TC276 cell characterization standard effort

Cell characterization "umbrella" standard – to ena understanding

Cell characterization measurement process standard

Jan 25-26, 2017 US-Japan Cell Characterization Workshop to develop an overarching standard

By attribute	By technique	By purpose	By cell type
Cell counting 1 & 2	Flow Cytometry	Cell therapy products	??
Viability ??	Imaging	Gene therapy products	??
...	...	Drug discovery	

Cell Counting Standards are under development; all others are listed as examples

Workshop Goals

- Raise awareness of the importance and challenges associated with cell counting measurements
- Develop and document best practices for cell counting
- Discuss options to address measurement challenges through collaborative studies (NIIMBL)
- Workshop outcomes to support the development of international standards and more specific measurement challenges