NISE network
NANOSCALE INFORMAL SCIENCE EDUCATION

**NISE NETWORK**

# Nano Exhibition

*Creating a Small-Footprint Exhibition with Big Impact*

**www.nisenet.org**

# Contents

# The NISE Network

*The Nanoscale Informal Science Education Network (NISE Net) is a national community of researchers and informal science educators dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology ("nano").*

The goals of NISE Net are to create a national community of partners to engage the public in nano, to develop and distribute educational experiences that raise public awareness and understanding of nano, and to generate knowledge about public and professional learning through evaluation and research.

NISE Net includes over 500 museums, universities, and other organizations. The Network is organized into regions, each with a regional hub leader who serves as primary point of contact and provides advice, encouragement, and support to partners. Network partners work together to engage the public in new topics related to science, engineering, and technology. Collectively, our efforts give the Network broad reach to diverse public audiences across the United States.

## 555 ORGANIZATIONS
regularly participate in Network activities



| 322 | 192 | 41 |
|-----|-----|-----|
| museums | universities | industries, other |

⭐ Regional hub

# STEM Learning and Engagement

**Nano** *enables science and children's museums across the country to engage visitors in learning about current science, engineering and new technologies.*

The goals of the Nano exhibition are to provide an opportunity for visitors to learn about key concepts related to nano and to create an engaging experience that would allow visitors to find personal relevance and meaning in the exhibition content. Through careful layering of messages and information, the exhibition allows broad access as well as deep exploration of content and ideas.

*Nano* **explores four key concepts:**

1. Materials can act differently when they're nano-sized.

2. Nanotechnology lets us build things the way nature does, atom by atom.

3. Nano is all around us, in nature and in technology.

4. Nanotechnology will affect our economy, environment, and personal lives.

These four concepts can be explored through interactive components, exhibition signage and graphics, reading materials, and an audio description. They are based on the NISE Net content map, which identifies essential content for engaging the public in nano (Bequette et al., 2012; Sciencenter, 2011).

Exhibit elements were designed to be easy to use, fun, and hands-on. They invite social interaction, extended use, and repeat use. The exhibition's themes, ideas, natural phenomena, and examples of technologies were carefully selected to be relevant, interesting, and accessible to a wide range of learners. Multiple modes of engagement and entry points allow visitors to investigate and learn.



The large graphics pose simple questions that invite visitors to explore the exhibition's four key concepts.

The key concepts are repeated and reinforced throughout the exhibition via hands-on experiences, attractive images, and concise text.



Content is layered, with simpler language and more general messages presented through the label headlines. More complex concepts and vocabulary are presented in body text and flip panels.



Reading cards and books offer deeper learning opportunities for visitors of different ages.

*"Families with kids of all ages love the exhibit. It has the right mix of hands-on activities that are engaging for children and also a fair amount of text to engage the older learners and adults. The exhibit has been very approachable for our audience and brings abstract concepts and technology to life for them."*

*- Sarah Fisk, The CNSE Children's Museum of Science and Technology, Colleges of Nanoscale Science and Engineering, Troy NY*

*Nano* makes connections to familiar objects in nature and visitors' own homes.

*"The* Nano *exhibition explains nanoscience in a way that visitors of all ages can relate to and comprehend. It provides opportunities for our audience to make personal discoveries through exploratory hands-on activities. The exhibit also offers layered interpretation as it showcases nanoengineering and technology, and introduces applications in daily life."*

*- Tammy Frazier, Louisiana Art & Science Museum, Baton Rouge LA*

## What's new about nano?

### What's new about nano?

**Nanotechnology lets us build things the way nature does—atom by atom.**

Tiny "building blocks" called atoms make up everything in the world. In nature, atoms combine in different ways to make different materials. Diamond, graphite, and carbon nanotubes are all made entirely from carbon. They're different because their carbon atoms are arranged differently.

In the field of nanotechnology, we're learning to build small, useful things out of individual atoms. Some new nanomaterials even assemble themselves!

### ¿Cuál es la novedad de nano?

**La nanotecnología nos permite construir cosas de la misma manera que la naturaleza: átomo por átomo.**

Pequeños "bloques de construcción" llamados átomos son la estructura de todas las cosas que hay en el mundo. En la naturaleza los átomos se combinan de distintas maneras para hacer distintos materiales. El diamante, el grafito y los nanotubos de carbono están hechos completamente de carbono. Son distintos porque sus átomos de carbono están organizados de manera diferente.

En el campo de la nanotecnología estamos aprendiendo a construir cosas pequeñas y útiles a partir de átomos individuales. ¡Incluso algunos nano-materiales nuevos se ensamblan por sí mismos!
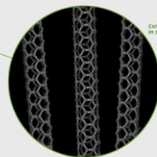
Graphite in pencil lead
Grafito en la mina de un lápiz

Diamond in a ring
Diamante en un anillo

Carbon nanotubes in shoe soles
Nanotubos de carbono en las suelas de los zapatos

*Nano* makes connections to fundamental scientific concepts visitors may have learned about in school, in the media, or elsewhere in the museum.



The exhibition is designed to promote conversation and positive social interaction among group members.



A rich variety of programming resources and media complement the *Nano* exhibition.

*Nano* encourages visitors to think about the social dimensions of science and technology, and our role in shaping the future.



Exhibit labels explore the relevance of nanotechnologies to global issues, including access to clean water, adequate and safe food supplies, new medical treatments, and sustainable energy sources.

# Best Practices in Exhibition Design

*With its compact size, rich learning experiences, and attractive design,* **Nano** *is a new model for exhibitions in science centers and children's museums.*

*Nano* was created through a rigorous, collaborative process with a variety of stakeholders. Experts in nanoscale science, engineering, and technology helped the exhibition team to understand this complex, interdisciplinary field, identify interesting research and applications, and ensure the exhibition content was accurate and up to date. Museum professionals and experts in learning helped us to present those concepts in engaging, accessible, and accurate ways through a variety of media. And potential hosts made sure we were aware of the opportunities and constraints at science and children's museums across the country, allowing us to create an inexpensive, long-lasting exhibition that is easily shipped, installed, and maintained. Based on this input, the exhibition team developed guidelines and criteria for the exhibition's content, interpretation, and design.

*Nano* is only 400 square feet in size, but it engages visitors in learning about all four of NISE Net's key concepts for nanoscale science, engineering, and technology through interactive components and real phenomena. The exhibition is designed to work in a variety of environments, with different physical layouts, varying staffing capacities, and diverse audiences.



The *Nano* development team included several different museums and expert advisors from a variety of fields.

# Smart, flexible design

*The exhibition's small footprint, modular components, and clean, appealing design allow it to fit into many museum environments.*





Simple materials and a neutral color palette work in many settings.



*Nano* is fun and engaging for all ages.

*"The Nano exhibit has filled our lobby with color, action, and excitement. We now have stations to linger, explore, and interact greeting our visitors, and providing one last image of the museum to take home."*
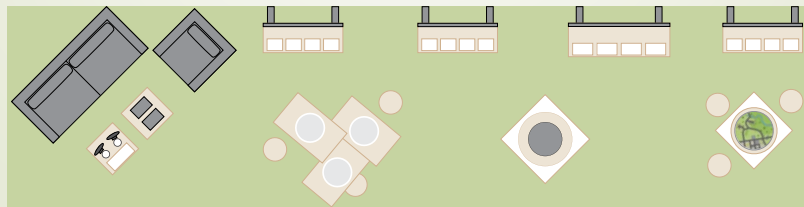
*- Gertrud Plummer, Maine Discovery Museum, Bangor ME*

**SQUARE** 20x20 feet

**CORNER** 35x20 feet

**LINE** 40x10 feet

Modular, flexible design allows installation in different configurations .



Seating area provides a comfortable place to rest, watch, and read.



Large graphic elements can be used to create a defined space.

# Easy installation and maintenance

*The exhibition's cost-effective design allows it to be produced and shipped inexpensively.*

*Nano* fits through regular doors and passenger elevators, allowing it to be installed in small museums. A few people, using basic tools, can set it up in just a few hours' time.



*Nano* uses durable materials and mechanisms, and low-tech components to minimize maintenance needs. (Only one electrical socket is needed!)



*Nano* is based on open-source content. Design documents, materials specifications, label text, and most of the photos and images are all available online through a Creative Commons license.

# Universal design

**Nano** *is an exemplary model of a safe, comfortable, and accessible exhibition.*

The exhibition's target audience is visitors to science and children's museums, particularly families with children ages 6-12. Individual components, as well as the recommended exhibition layouts, were carefully designed to be accessible to multiple and diverse audiences, including visitors with a range of cognitive and physical abilities and from diverse cultural backgrounds.



Accessible features were designed in consultation with universal design experts, as well as individuals with a variety of physical disabilities.





All exhibition materials are designed according to universal design principles and ADA standards.

The exhibition accommodates individuals of different heights, abilities, and degrees of mobility. Visitors can stand, sit, and move through the exhibition in different ways.



Input and review by experts helped ensure the exhibition was welcoming and inclusive of visitors of diverse backgrounds.





"Nano *allows us to welcome a wide range of visitors in a complex topic in an engaging way.* Nano *is our first permanent bilingual exhibit and the accessibility for the vision and hearing impaired has been a wonderful addition to our institution.*"

- Allison Schwanebeck, Science Center of Iowa, Des Moines IA

English and Spanish are presented equitably throughout the exhibition. Content was reviewed for cultural sensitivity and scientific accuracy in both languages.

# Impact on Museum Audiences

***The* Nano *exhibition is the NISE Network's biggest public engagement initiative. Over 100 sites across the United States will host the exhibition, reaching millions of people each year.***

*Nano* successfully presents challenging content through interactive exhibits, compelling objects and images, comprehensible text, and a range of related programs and media. It transforms a topic that most visitors find not only unfamiliar but also unpromising into an experience that visitors find highly engaging and relevant.

*Nano* was informed by visitor evaluation and research on learning during all phases of its planning, development, and implementation. Efforts include front-end research, formative evaluation, summative evaluation, and research into visitor learning.

## *Front-end and formative evaluation*

Front-end research shaped the exhibition's content messages and interpretive strategy. This work indicated that visitors were likely to have little familiarity with nano and its potential applications (Flagg, 2005), so the exhibition focuses on providing foundational knowledge, creating links to everyday life, and explaining the potential of nanotechnologies to address major societal issues that are interesting and relevant for broad public audiences.

Formative evaluation allowed the development team to test and improve prototypes of individual components as well as the entire exhibition. Formative evaluation was conducted at two different



museums, a large science center located in an urban area and a small science center located in a rural area. It was conducted with general public audiences, as well as bilingual English-Spanish family groups and individuals with disabilities.

## *Summative evaluation results*

Summative evaluation was performed at seven museums, and included bilingual English-Spanish families and individuals with disabilities. The seven museums varied in size, type, audience, and region of the country. Evaluation results indicate that the exhibition meets all of its intended goals with regard to visitor learning and engagement: visitors find the exhibition enjoyable, interesting,

relevant, and family-friendly; it promotes age-appropriate learning for both adults and children; it encourages talking and positive social interaction among groups; and visitors stay in the exhibition a long time (Svarovsky et al., 2013).

The summative evaluation also indicates that the exhibition reaches a large and diverse audience. Calculations based on data gathered during the summative evaluation estimate that a total of 22-28 million visitors will see the exhibition by the end of 2015 (Svarovsky et al., forthcoming).

*Nano* is accompanied by programming and media resources developed by the NISE Network. Because *Nano* explores the same four key concepts as other NISE Net educational resources, museums can use hundreds of programs and media to complement the exhibition, all available for free download from nisenet.org. These materials allow staff to integrate exhibition content into efforts across the museum. The exhibition's summative evaluation indicates that the great majority of partners (87%) report implementing new or expanded programming as a result of hosting *Nano* (Svarovsky et al., 2013).

> *"The exhibition has made the public more aware of nanotechnology, its importance, and relation to one's everyday experience. It has broadened our staff knowledge and pointed out ways to relate the information to all areas of science and technology."*
>
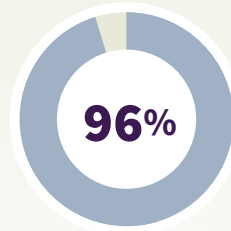> *- Cassandra Henry, Science Spectrum, Lubbock TX*





The exhibition provides a setting for hands-on activities and conversations .
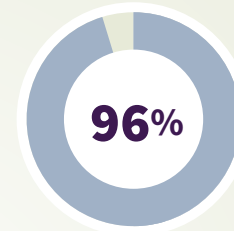
By the end of 2015

## 22 MILLION PEOPLE

will visit the *Nano* exhibition

**96%**
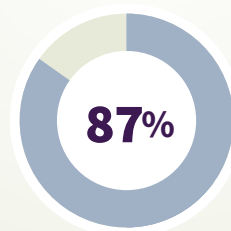
of visitors say the exhibition is enjoyable

**96%**

of visitors say the exhibition is interesting

**6min**
7 sec
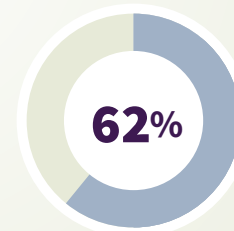
is the average dwell time

## *Nano* is ENGAGING for visitors

Visitors describe the exhibition as interactive, informative, and family-friendly

## Visitors are LEARNING in *Nano*

**87%**

of visitors use the exhibition components in groups

**62%**

of visitors can name one or more of the exhibition's four key concepts

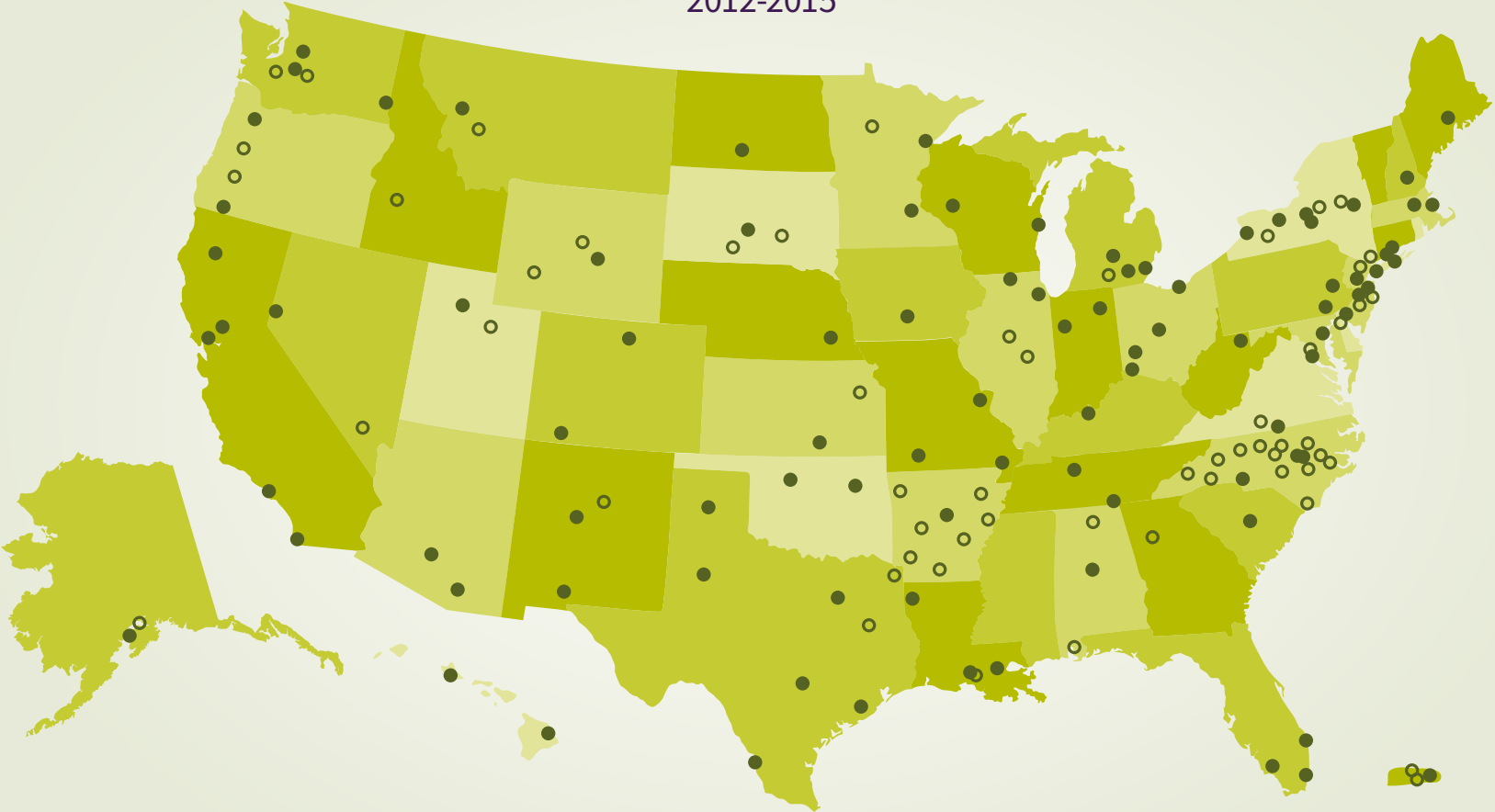**59%**

of visitors made connections between the exhibition and their daily lives

# EXHIBITION LOCATIONS
## 2012-2015

**93**
mini-exhibitions

**140**
museums

**9**
universities

• exhibition owner
○ exhibition share

# Saint Louis Science Center





*Saint Louis Science Center*

*"We have seen great visitor interactions with and public reaction to the Nano exhibition. In fact, visitors have indicated that the exhibition was the highlight of their experience at the science center."*

*- Paul Freiling, Saint Louis Science Center, Saint Louis MO*

# Port Discovery Children's Museum





Tracy Brown Photography / Wikipedia

*"The Nano exhibition has greatly increased the capacity of Port Discovery's STEM learning platform. It has allowed us to expand our reach while providing the knowledge and confidence for the museum to explore new topics in STEM fields."*

*- Sarah Zimmerman, Port Discovery Children's Museum, Baltimore MD*

# Natural History Museum of Utah





Jim Nista / Wikipedia

*"The* Nano *exhibition has made a significant impact on our organization and the visitor experience. Visitors have active, prolonged engagement with the exhibit, especially the hands-on activities."*

- Tim Lee, Natural History Museum of Utah, Salt Lake City UT

# Da Vinci Science Center



Dennisze / Wikipedia



"Nano *has immediately become one of our visitor favorites in visitor surveys. I have seen families talking about nano and how the new technologies might impact them. It has sparked conversations between guests and our staff.*"

*- Karen Knecht, Da Vinci Science Center, Allentown PA*

# Princeton University, Princeton Public Library, and New Jersey State Museum





John Phelan / Wikipedia



www.nj.gov

*"The exhibit has expanded our partnership with the Princeton Public Library and has led to a new partnership with the New Jersey State Museum. The exhibit gives us a daily presence in two different communities in need of science education support, and increases our ability to reach out to diverse audiences."*

*- Daniel Steinberg, Princeton University, Princeton NJ*

# Center of Science and Industry





*"The Nano exhibition brings science content to life. From the durability and quality educational experiences, to the supporting technical, maintenance, and educational materials, we are very pleased with the exhibition."*

- Joshua Sarver, Center of Science and Industry (COSI), Columbus OH

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