
**Sonya Darter**

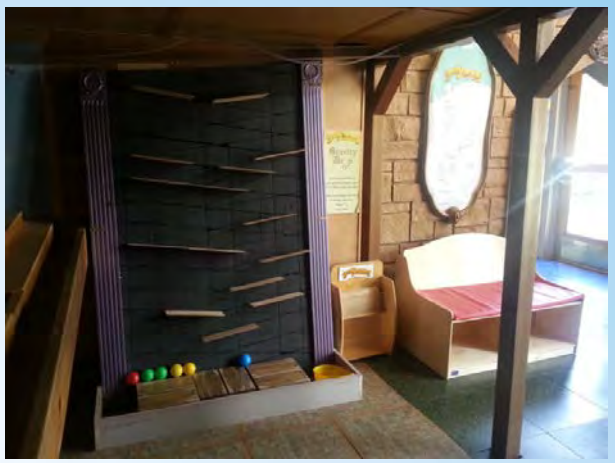
Executive Director

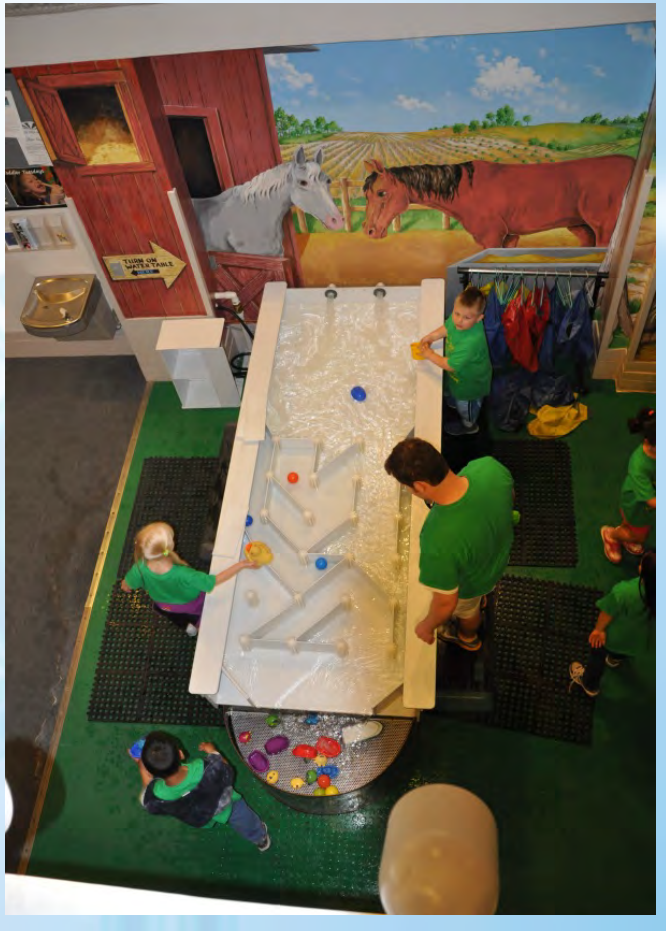
# How
# 3 Midwest Museums get
# Nano!
# into their buildings


I
NANO


discovery center MUSEUM
Children's Discovery museum
ORPHEUM
CHILDREN'S SCIENCE MUSEUM
A
B
C
Monroe
Kenosha
Harvard
McHenry
Rockford
South Haven
Benton Harbor
Arlington Heights
Elgin
Rochelle
Dekalb
Dixon
Clinton
De Witt
Chicago
ORD
Downers Grove
Aurora
Michigan City
South Bend
Elkhart
Hennepin Canal Parkway State Park
Sandwich
Tinley Park
Gary
Joliet
Davenport
Geneseo
Valparaiso
Princeton
Peru
Ottawa
Morris
Plymouth
Lowell
Warsaw
Kewanee
Kankakee
Rochester
Galesburg
Rensselaer
Pontiac
Watseka
Monticello
Logansport
INDIANA
Bloomington
Hoopeston
Kokomo
Lafayette
Lincoln
Clinton
ILLINOIS
Monticello
Noblesville
Beardstown


ORPHEUM
CHILDREN'S
SCIENCE
MUSEUM






What does
nano
mean for us?
What's
new
about nano?


nd nano?
new

discovery center MUSEUM

# Rotation Schedule

- 4 month rotation between each museum
- Each museum has the exhibit during different seasons over 3 years
  - NanoDays
  - Summer
  - Field trip season
  - Fall

# Programming around the exhibit is easy with NISE Network resources!

- Turns nano into a daily experience
- Facilitated by volunteers, interns, and education staff
- Creates a longer dwell time

# Train your floor staff and program guides!

- Exhibit component manual
- Educator’s guide
- Nano posters

# Exhibit Maintenance

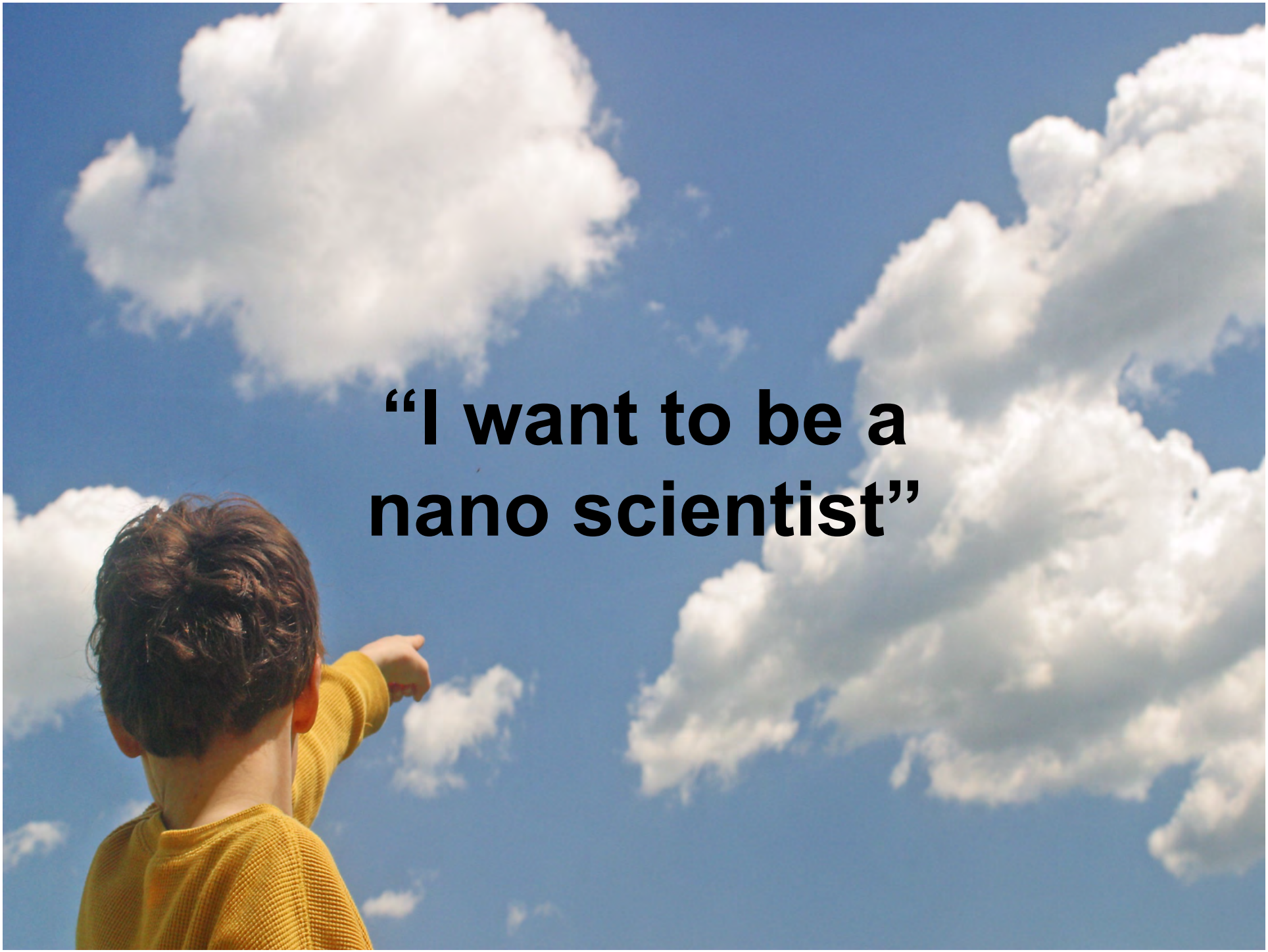
- Maintenance is super easy
- Exhibit is really heavy
- Very easy to configure

# 3 Recommendations

- Train your staff and volunteers!
- Partner with local scientists and engineers
- Utilize NISE Network resources

# 3 Reasons We Would Do It Again

- Reached walk-in visitors with nano on a daily basis
- Increased literacy, confidence, and interest in nano
- Provides new experiences and increases awareness


“I want to be a
nano scientist”

# Nano Mini-Exhibition: *Getting Nano in your Building*

South Dakota Discovery Center
Pierre, SD

Kristie Maher,
Executive Director

NEWS RELEASE – For Immediate Release

Experience Nano  at the SD Discovery Center
*Local science center granted a new exhibition.*

# NANO EXHIBITION on display

The SD Discovery Center in Pierre has taken delivery of a brand new exhibit. Nano – Imagine and discover a world you can't see! is now on permanent display.  The Center applied to the Nanoscale Informal Science Education Network (NISE Net) to be sele fif nt, build tio

"We pu e in my t te to our e N Net c c try.

Mah eir i- pod ut s that



The Center will soon be adding a Nanotechnology Family Science Night kit to its "Science to Go" loan kit program this fall.  Schools, afterschool programs, scouts, churches and other organizations will be able to rent it to put on a fun, simple family night.

# NANO DAY *to go!*

- The SD Discovery Center has an extensive teaching kits and family festival loan program. We've made both **Nano Day kits available for loan.**

# NANO DAY at the Center

- Nearly 300 children participated in Nano Day 2013 at the Center. It was held during an early release from school day.

# NANO
## for girls in science

Nano scientist, Yao Bing, of the University of South Dakota presented on **nano-careers** at our 2012 conference. She use the **Nano Gold activity** as part of her presentation.

The **Nana Days kits** were hosted by our local AAUW branch during the 2013 Pierre WIS exhibit hall.

WIS participants **tour the Nano exhibit** during the closing reception annually.


# Inspiration!

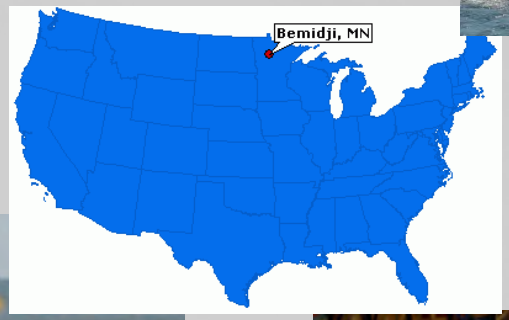
The Stanley County, SD FIRST Legos Robotics team designed **"nano pants."** They are wearing their pants as they accept awards for the project.


During their research, they visited our **NANO exhibit**, they used the **NISE Network website** where they connected with a **nano-scientist** from the Oak Ridge National Laboratory. In an extensive meeting with him they presented their product and received feedback and mini-lessons.

# NANO future possibilities


- **Nano camps** for middle and high school kids. Partner with universities to design and present the camps. Use **nano exhibit and kits** as part of curriculum.
- **Traveling Nano festival** - our staff would take Nano Days kits on the road to schools, fairs.
- Loan out the **Nano Mini Exhibit** to museums or libraries in the state.

# Headwaters Science Center Bemidji, MN





DELTA

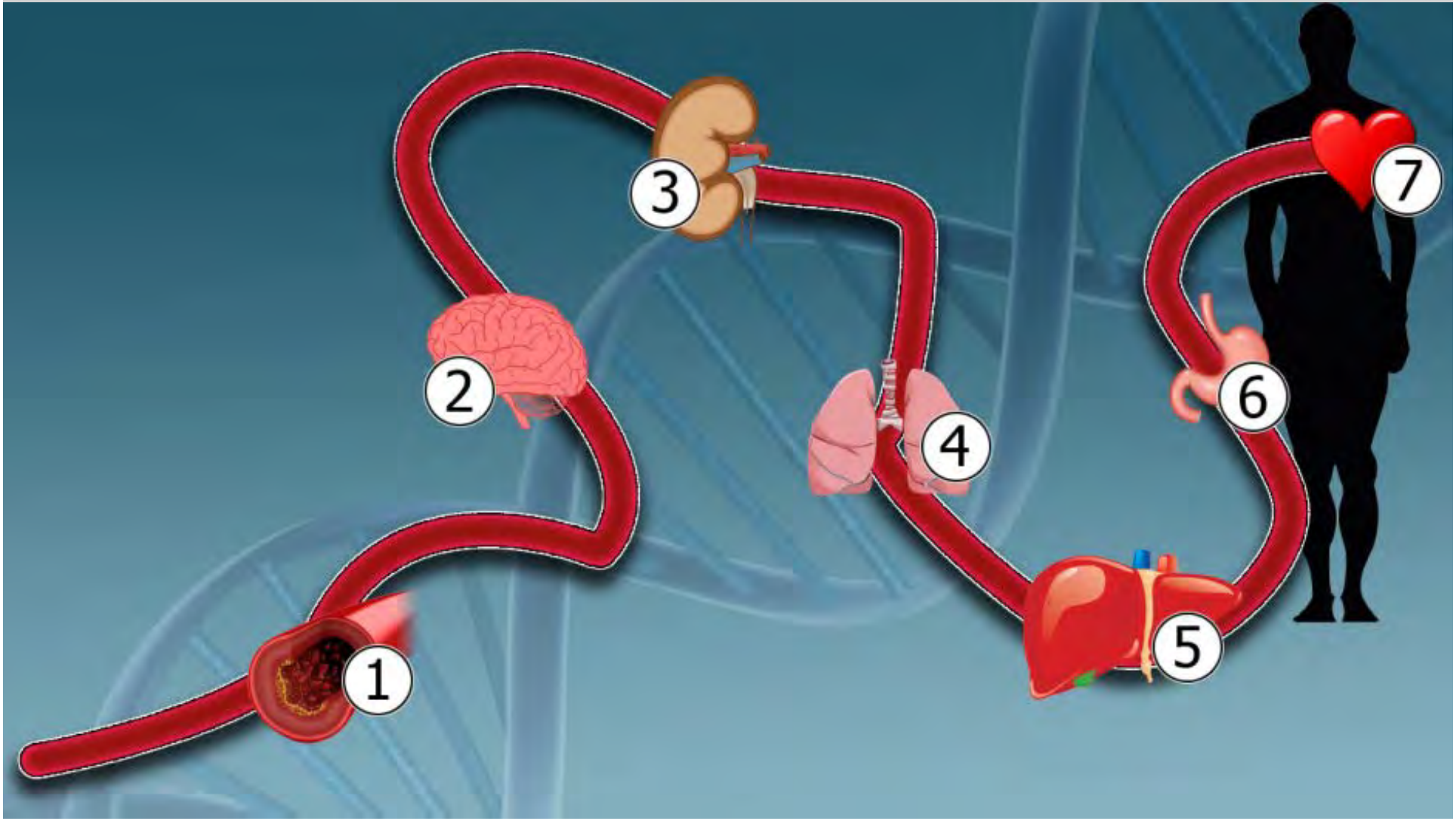

Everything is
made of atoms.

**Everything is made of atoms.**

# http://htwins.net/scale2/


# Iurie Gutu from Moldova in E. Europe

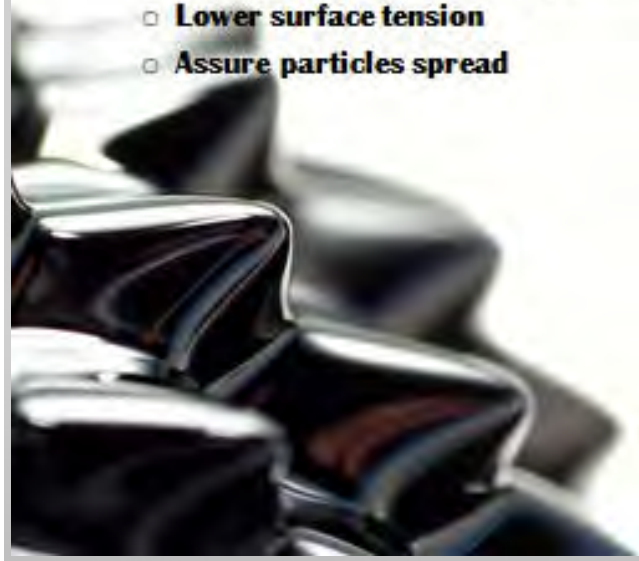
# Nano Game Map



# What is Ferrofluid?

- A magnetic fluid invented by NASA during the 1960's to pump fuel when in outer space
- Comprised by volume
  - 85% carrier oil
  - 10% surfactant
  - 5% magnetite (nano-sized magnetic solids)

- Surfactants → "Surface active agents"
  - Organic molecules with
    - Hydrophilic (*water-loving*) heads
    - Hydrophobic (*water-repelling, oil-loving*) tails
  - Lower surface tension
  - Assure particles spread

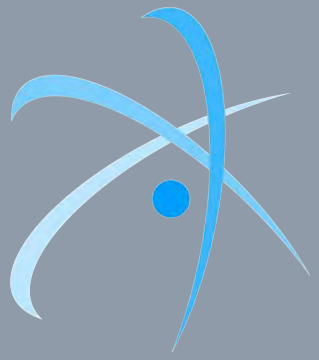


# What is going on here?

- A powerful electromagnet initiates a magnetic field through the large steel bolt
- Ferrofluid flows into the varying flux (quantity of magnetism) orienting itself along magnetic field lines
- van der Waal's interactions push and pull at the nanoscale
- Surfactants keep particles from clumping
- Meanwhile gravity drags the shiny colloidal liquid downward

NSF

NISE network
NANOSCALE INFORMAL SCIENCE EDUCATION



# Gateway to Science

Bismarck, North Dakota


Gateway to Science
Presents:
SPECTACLES IN
SCIENCE

Museum Day Live! Presentations

Student staff members were trained on three different Nano demos.

# Nano: Explaining Scale

# Nano: Exploring Size

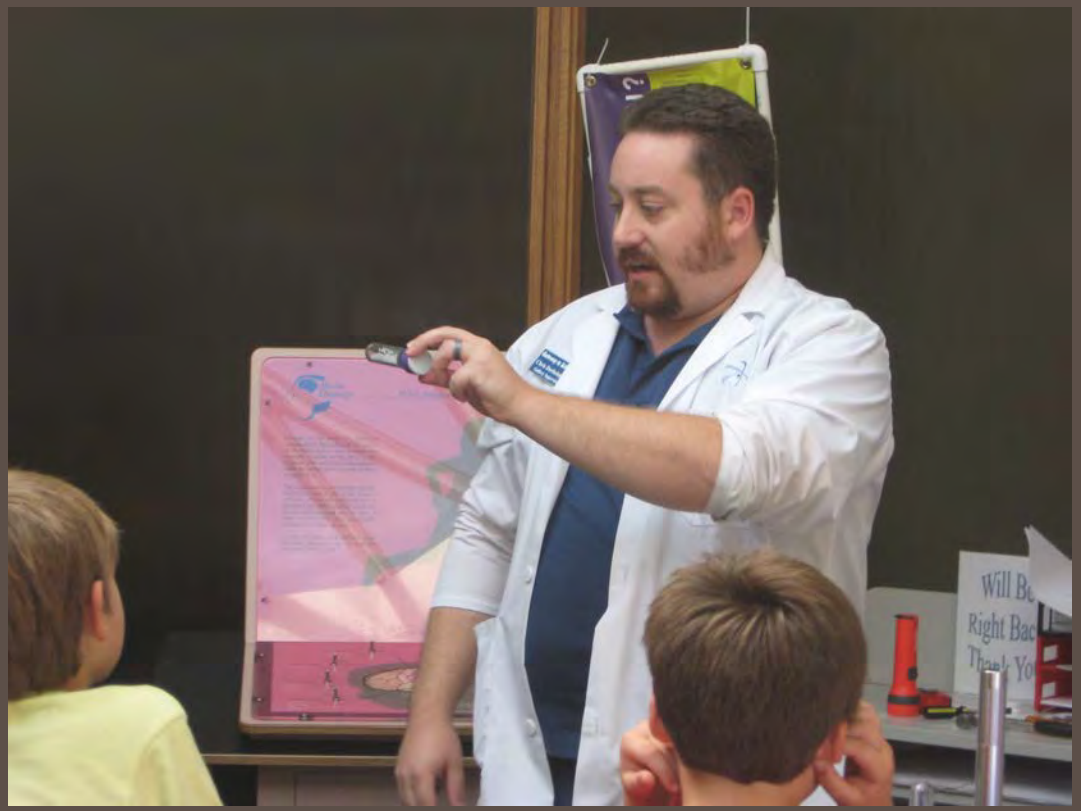
(Big Cup, Little Cup)

# Nano: Exploring Materials

(Invisibility)

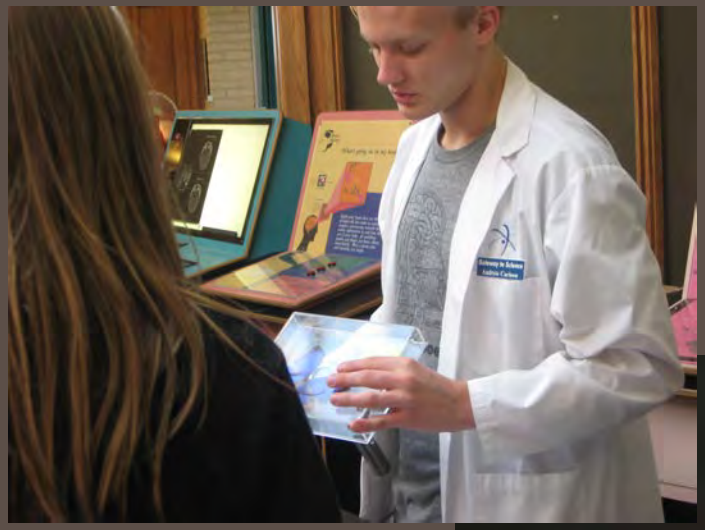
# Nano: Exploring Properties

(Static Tubes)



Portable Lab Cart makes a great staging area for demos in a small science center.

Nano activities from prior NanoDays and Small Wonders programs worked well as in-gallery demos.



# NanoDays at the Children's Museum of Eau Claire

## A partnership between the UW-Eau Claire Materials Science Center and the Children's Museum of Eau Claire

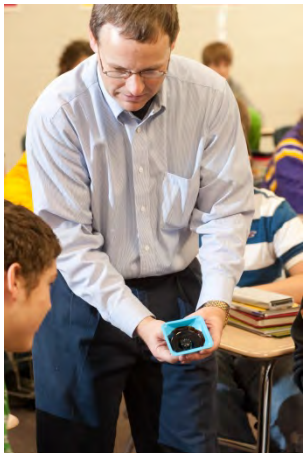
Doug Dunham, UWEC Materials Science Center Director
Traci Messner, Children's Museum of Eau Claire, Creative Kids Director

Children's Museum of Eau Claire

University of Wisconsin-Eau Claire
MSC
Materials Science Center
Your Partner in Innovation

# History of NanoDays at UW-Eau Claire

Presentations for several years at K-12 schools in northwestern Wisconsin



Hands-on Activities using the NanoDays kits in 2012, held at UWEC



Partnership with Children's Museum of Eau Claire

- Excellent community connect point
- Great venue
- Additional promotion for the event


EXIT
Asbi


I'VE BEEN

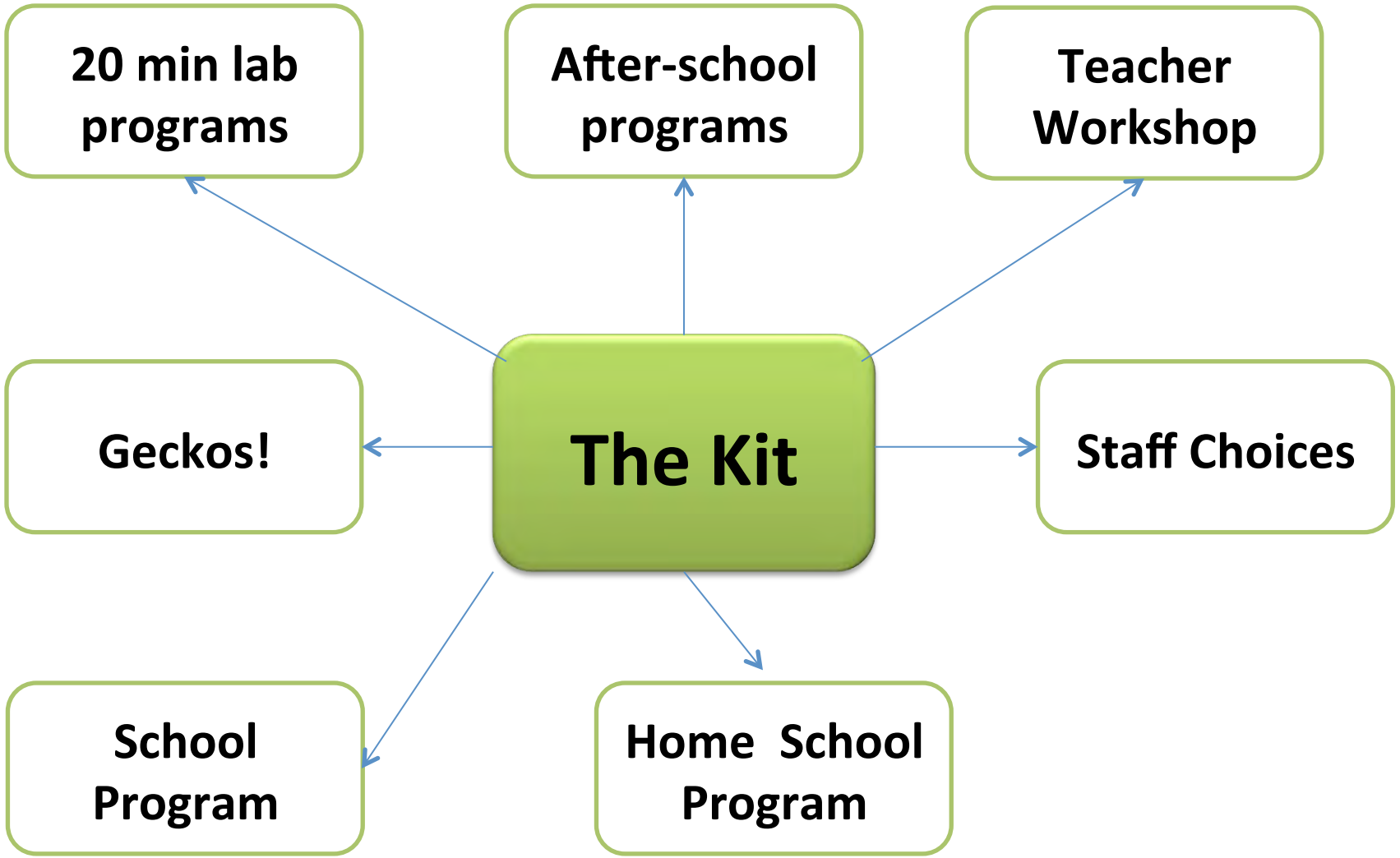

WOMEN

Making it work efficiently:

# Breaking Out of the Kit

The Children's Museum of Indianapolis

Becky Wolfe


20 min lab programs
After-school programs
Teacher Workshop
Geckos!
The Kit
Staff Choices
School Program
Home School Program

# Our Process

- Lab Programs
  - Life science focused lab
  - What nano connections to life science?
- School/Family programs
  - What are the desired outcomes for the program?
  - How can nano achieve those objectives?
  - Nano is often imbedded, not driver

# Programs

- Lab Programs
  - 20 min
  - Mix of kit and new demos
- School Programs - modified kit
- Home School
  - Used kit for self-directed
  - Added facilitated pieces

# Staff Choices

- SciencePort
  - Self directed family activities
  - Staff guide, not teach
- Staff Activity Choice
  - More activities than space
  - Staff chose kit activities
- Regular rotation – staff love the personalization

# Temporary Nano!

- Geckos exhibit – perfect nano!
- Cannibalized the kit for gecko events
- Great nano infusion; provided context

# Teacher Workshop

- Just Nano
- Infused into Geckos
- Supplemented NISE materials for a classroom
  - Inquiry
  - Data collection

# Bootheel Youth Museum

## The question is: when aren't we including Nano? Answer: Almost Never!

- On the Floor cart demos (although we don't have a cart)
- In Science Shows and demos
- On the Road: in schools, churches, community fairs and scout dens.
- In museum workshops
- At the gym

# Science Relay Presents by AmeriCorps

# Science Relay

# Science Relay

# Nano On the Road

Science Show: The Importance of Breathing

# Nano Wrestling: Bootheel Gymnastics

# On the Road: Nano Wrestling

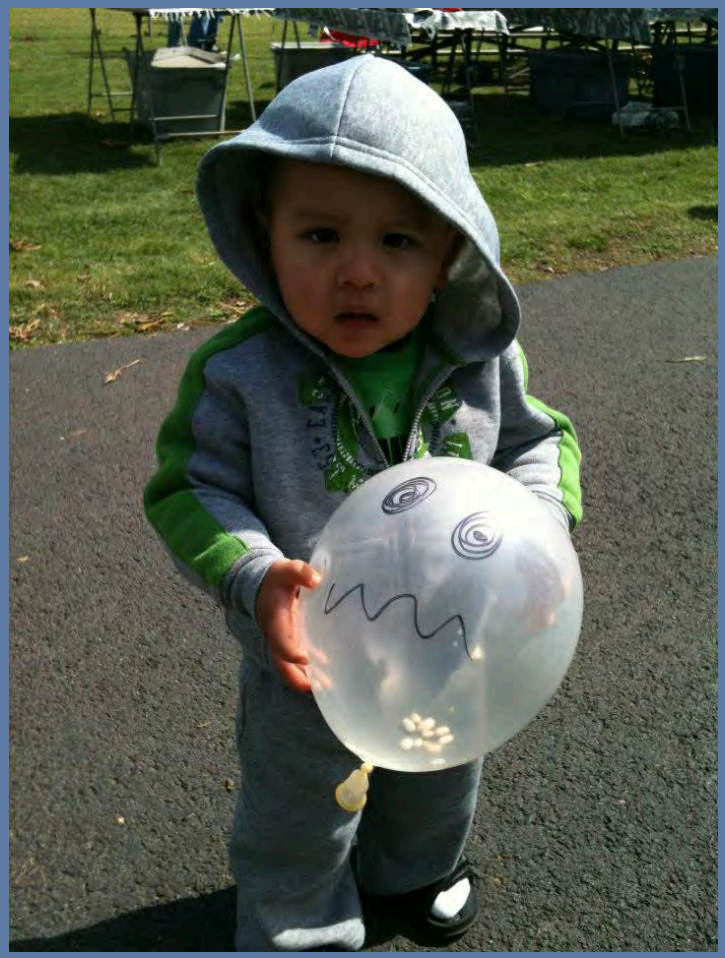
# Nano Wrestling

# Two Weeks of After School Programming

# Floor Activities

# Floor Activities

# Why Can't I Smell the Flower



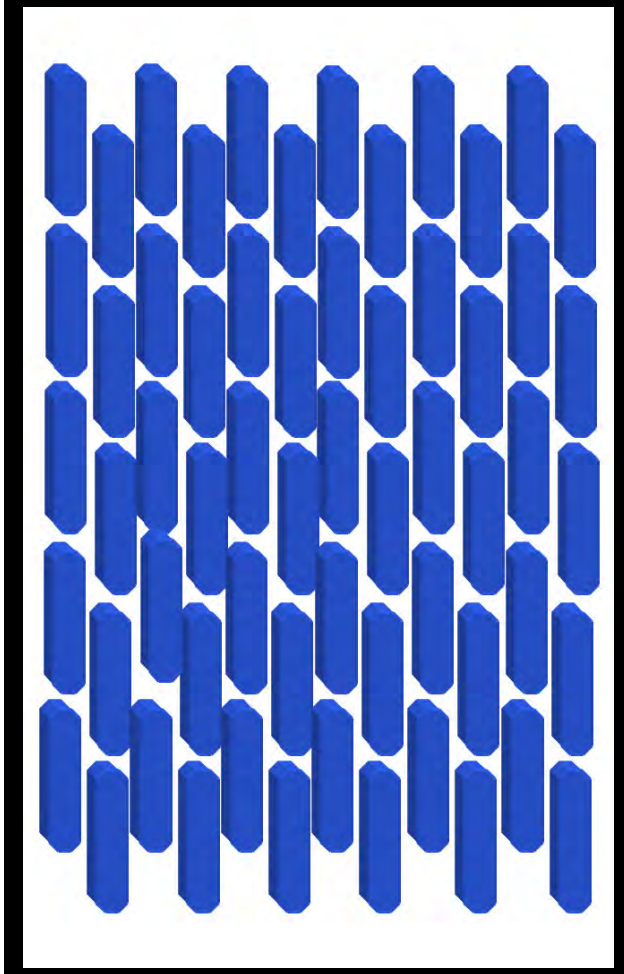
# Nano Theater

# Liquid Crystals

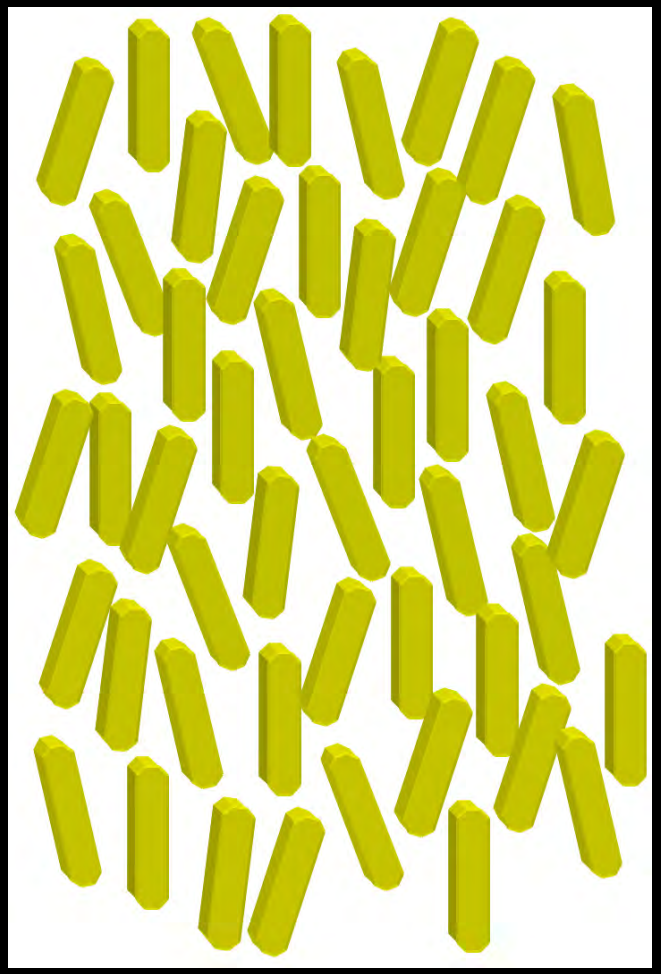
Ben Taylor
Interdisciplinary Education Group
University of Wisconsin-Madison



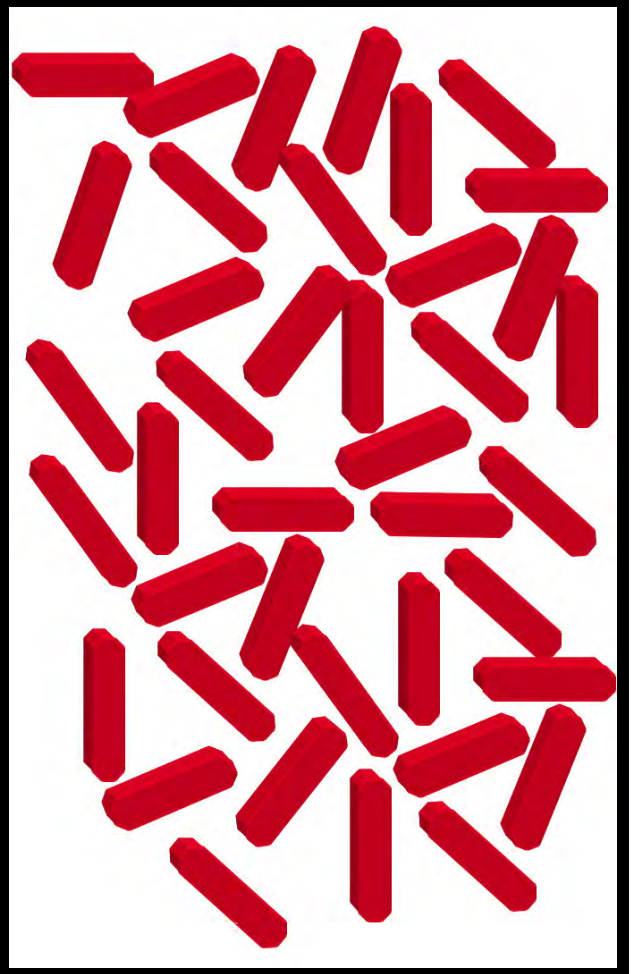

# Liquid Crystals (LC)



Solid



Liquid Crystal



Liquid

MRSEC

IEG

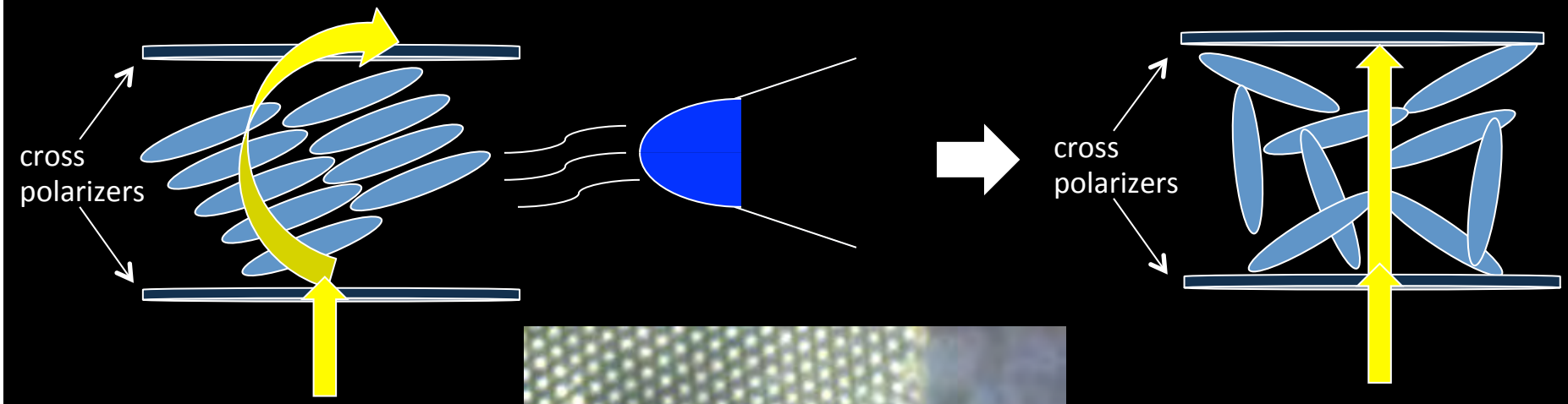
# External Forces Affect the Liquid Crystals

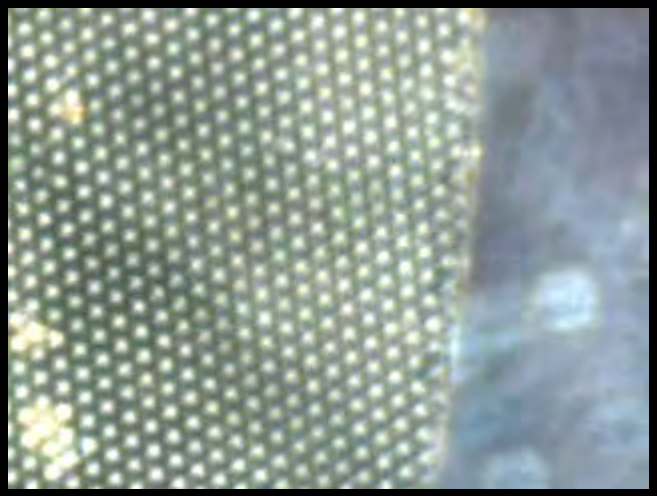
- Temperature
- Electric Current
- Magnetic Field

Affecting the alignment affects the color.

# Liquid Crystal Sensor

- Sensor = thin film of nematic L.C.
- Nematic phase has anistropic optical properties
- When viewed through crossed polarizing lenses, the sensor appears bright.
- Marker vapor disrupts the LC organization, sensor appears dark.

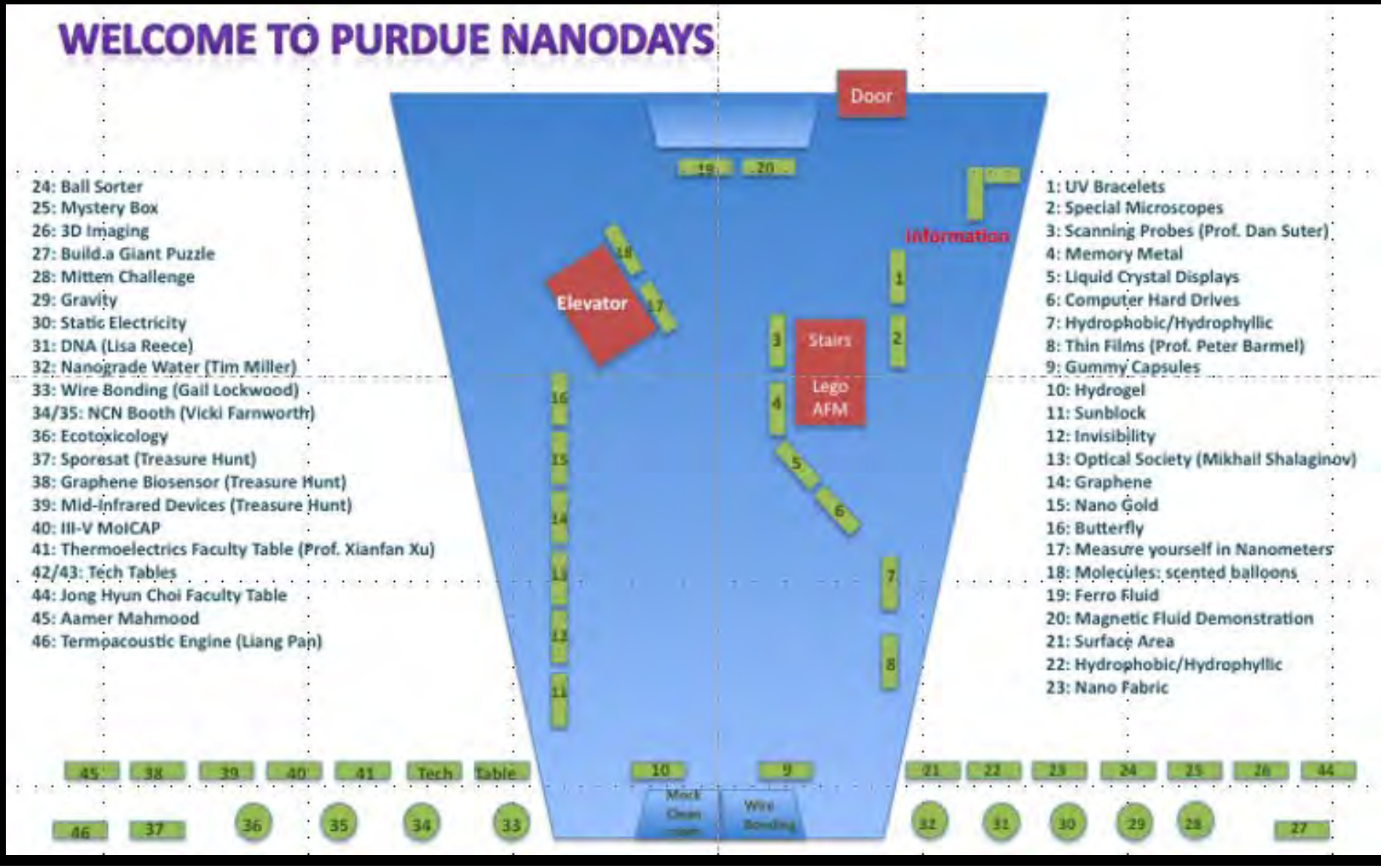


# A quick view of NanoDays 2013 at Purdue

Dr. Tanya Faltens
Purdue University

# Activities Layout- 46 tables + Mock Cleanroom and Wirebonding

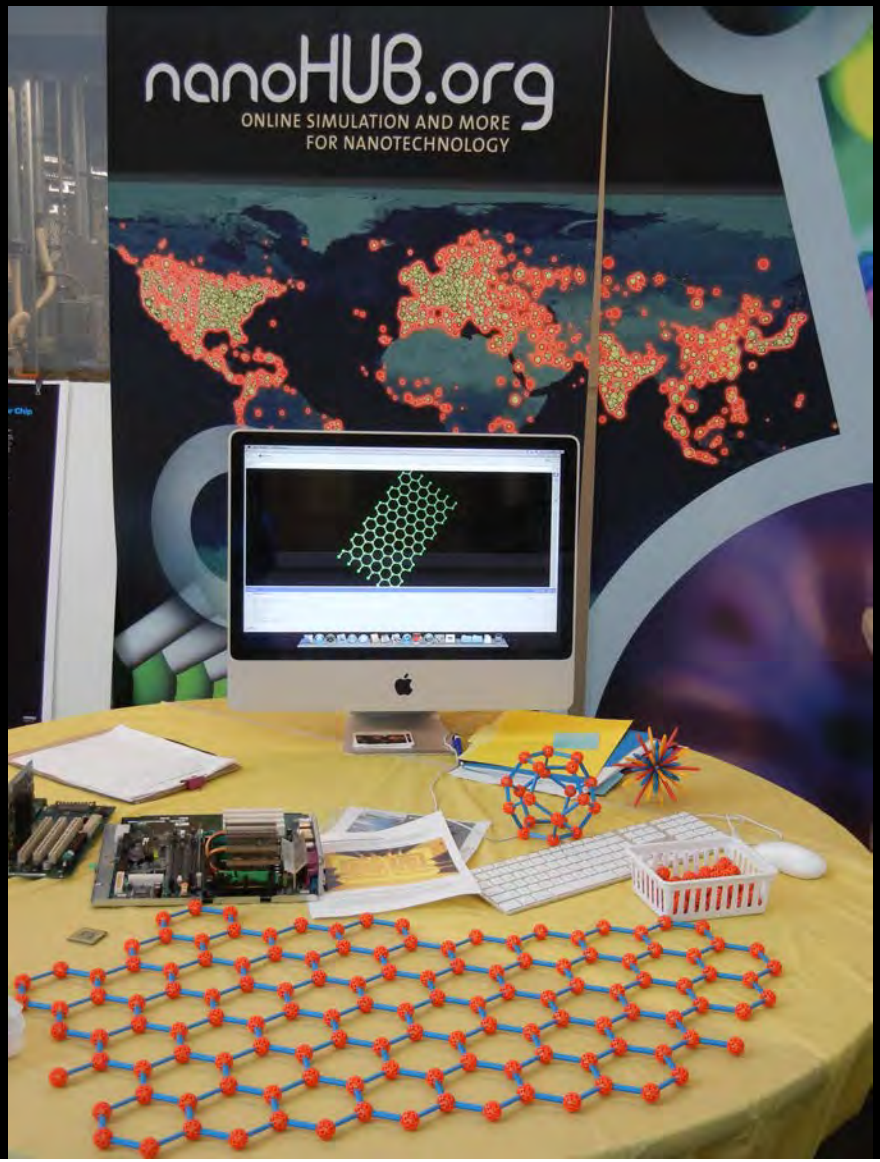


# NanoDays Talks

| Time | Burton D. Morgan, Room 121 | Birck Nanotechnology Center |
|---|---|---|
| 9:30 am - 10:30 am | Lisa Reece, Biosafety Research Engineer - The Delicious Science of Nanocrystillization: Nano Ice Cream! | |
| 10:30 am - 11:00 am | Robert Moon, Adj. Associate Professor of Materials Eng. - NanoTrees: Making Paper Stronger than Steel | Guy Telesnicki, Supervisor, Bio-Cleanroom - How to Make Nanoparticles Room 1001 |
| 11:30 am - 12:00 pm | Christy Cooper, Basic Medical Sciences Doctoral Student - Cleaning Water with Nanoparticles | Matt Stensberg, Agriculatural & Biological Engineering Doctoral Student - Nano Silver Room 1001 |
| 12:00 pm - 1:00 pm | Lisa Reece, Biosafety Research Engineer - The Delicious Science of Nanocrystillization: Nano Ice Cream! | Desiree White-Schenk, Biomedical Engineering Doctoral Student - Treating Cancer with Nanoparticles Room 2001 |

# Crystal Viewer Tool

http://nanohub.org/resources/crystal_viewer



# Introducing Modeling: Graphene

# Carbon Nanotube

# Building a CNT

# Structural Defects!

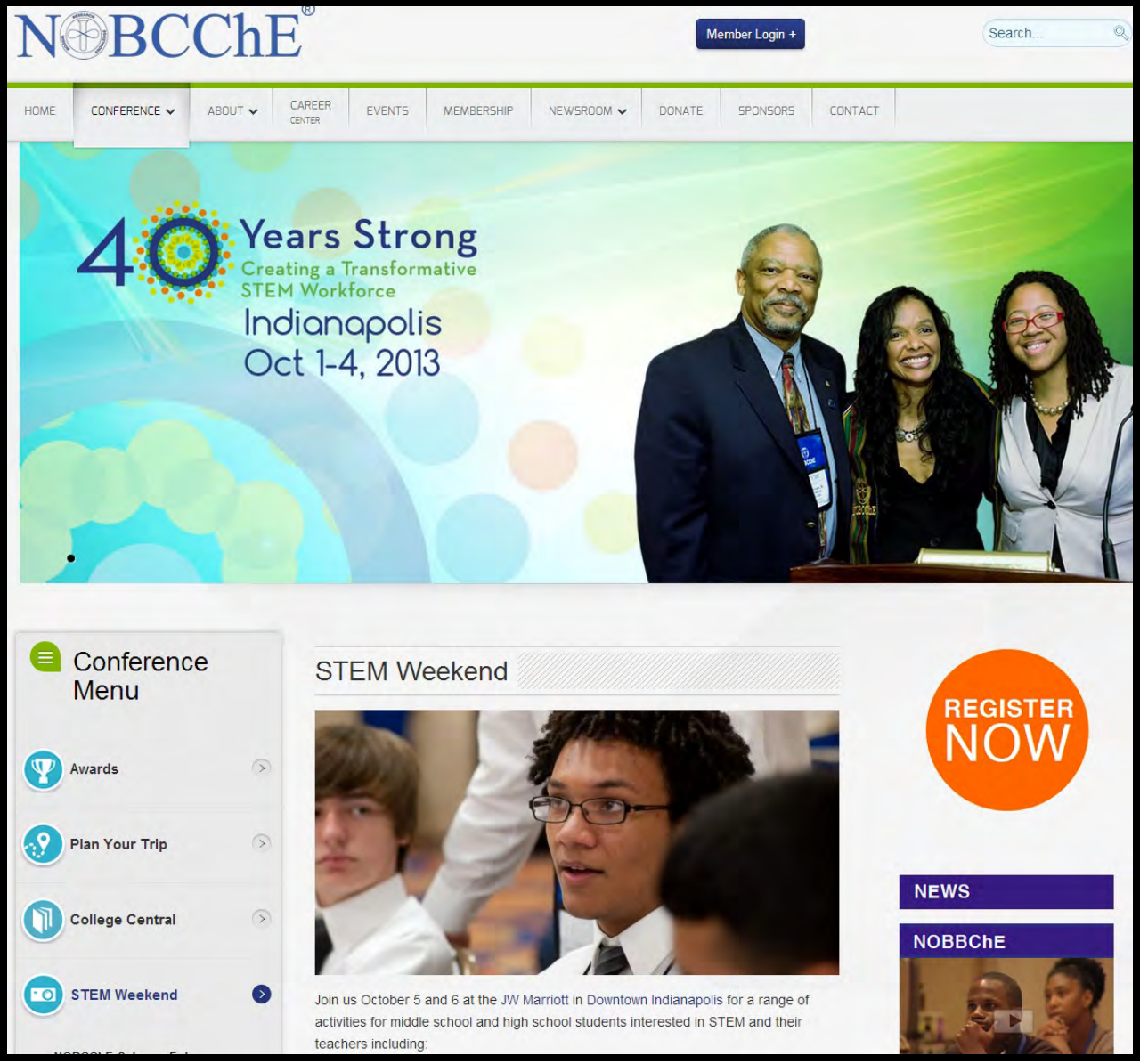
# Entering structural parameters

# Rock Candy

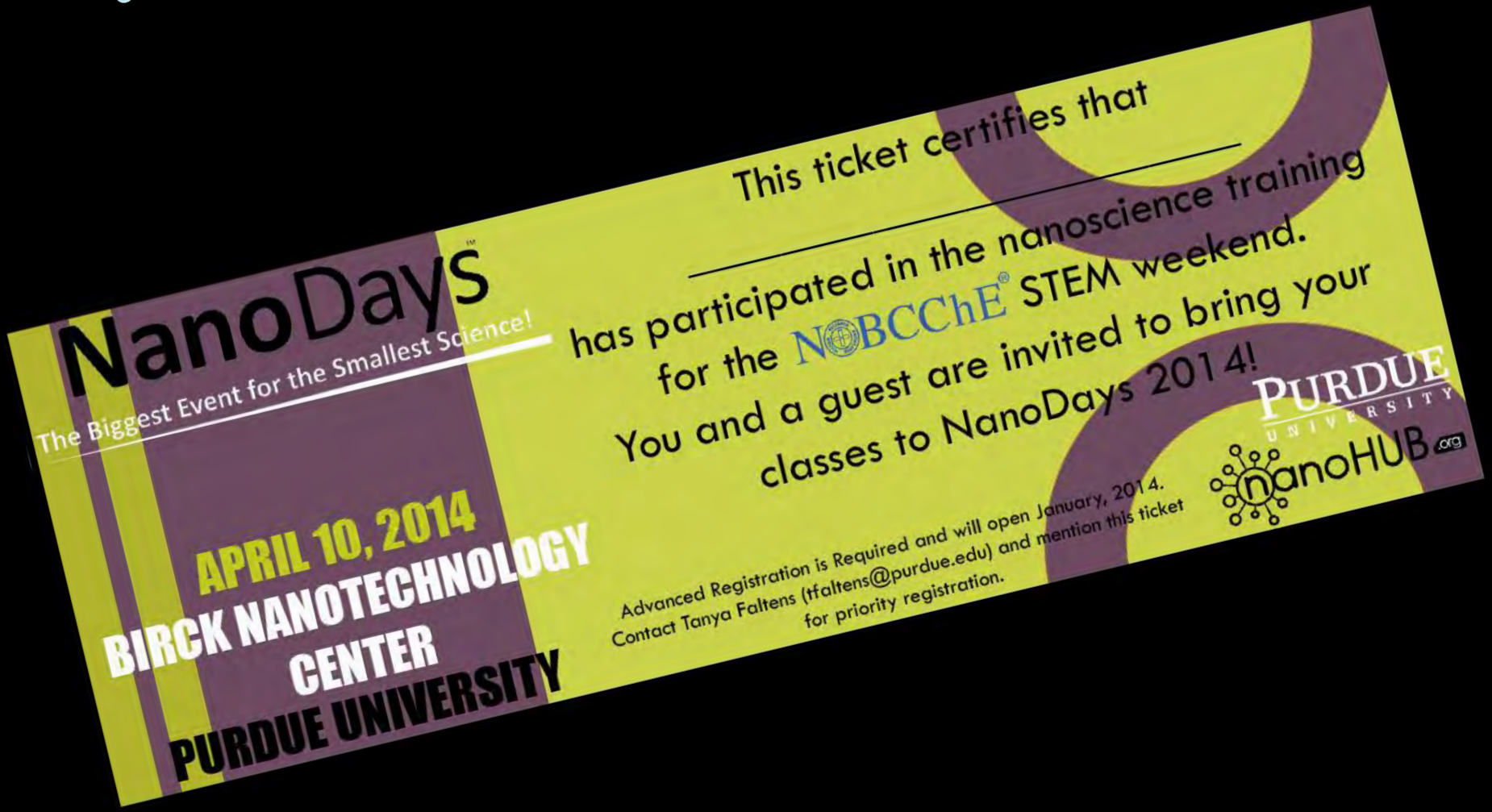
# Bucky Ball

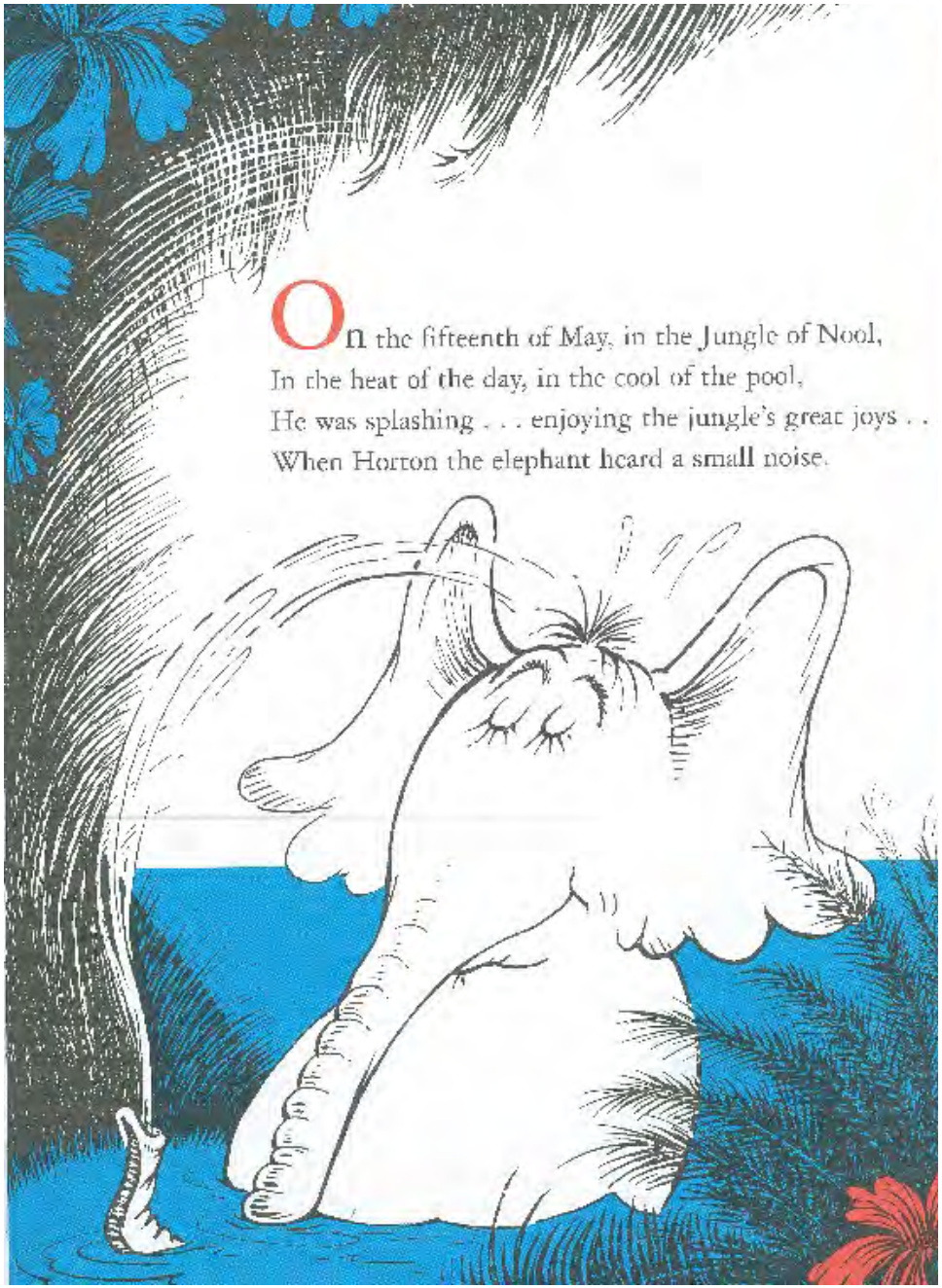

nanoHUB.org
ONLINE SIMULATION AND MORE
FOR NANOTECHNOLOGY

# NOBCChE STEM Weekend Oct. 5- Middle School Teacher Workshop

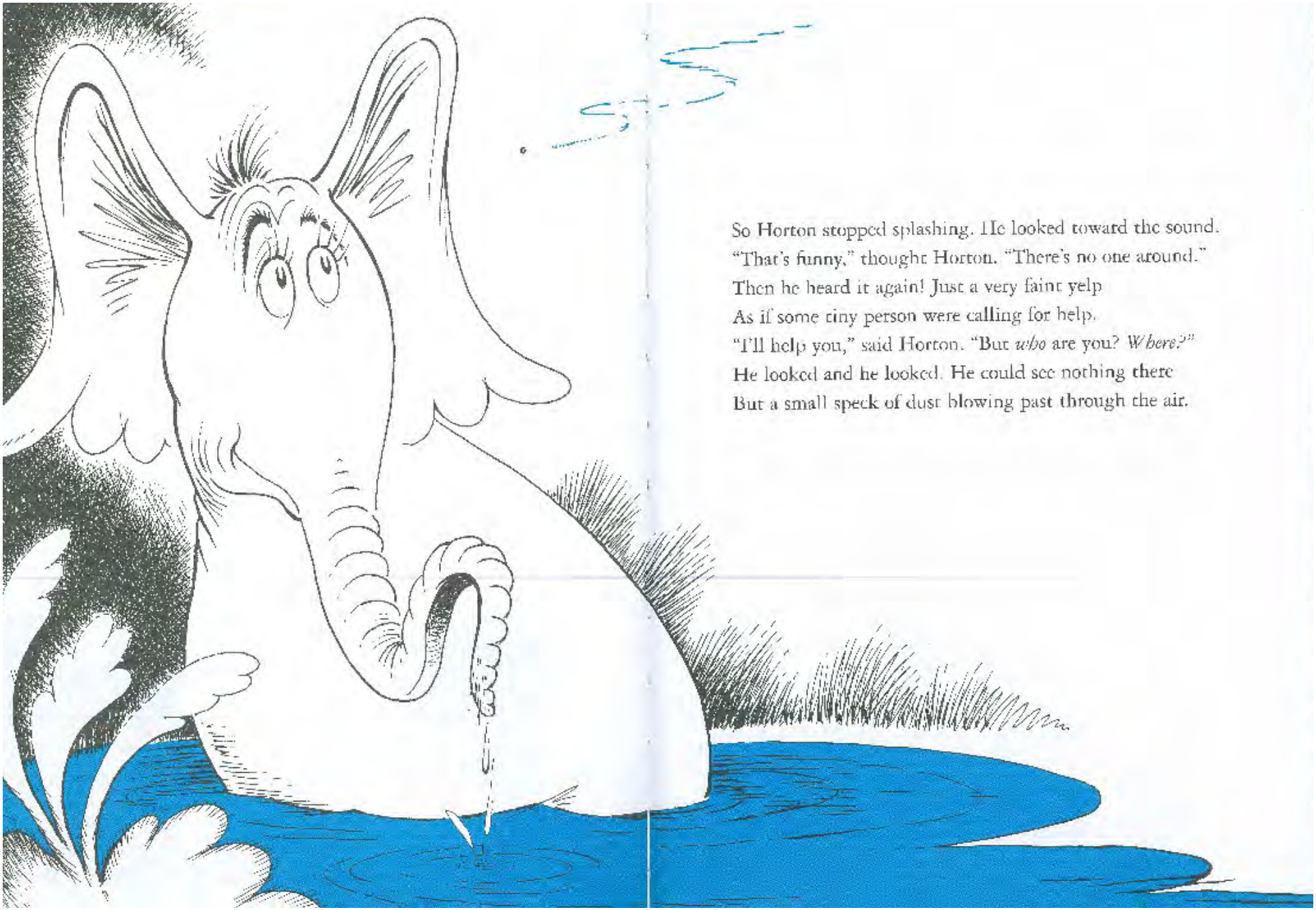


# Invitation to NanoDays 2014

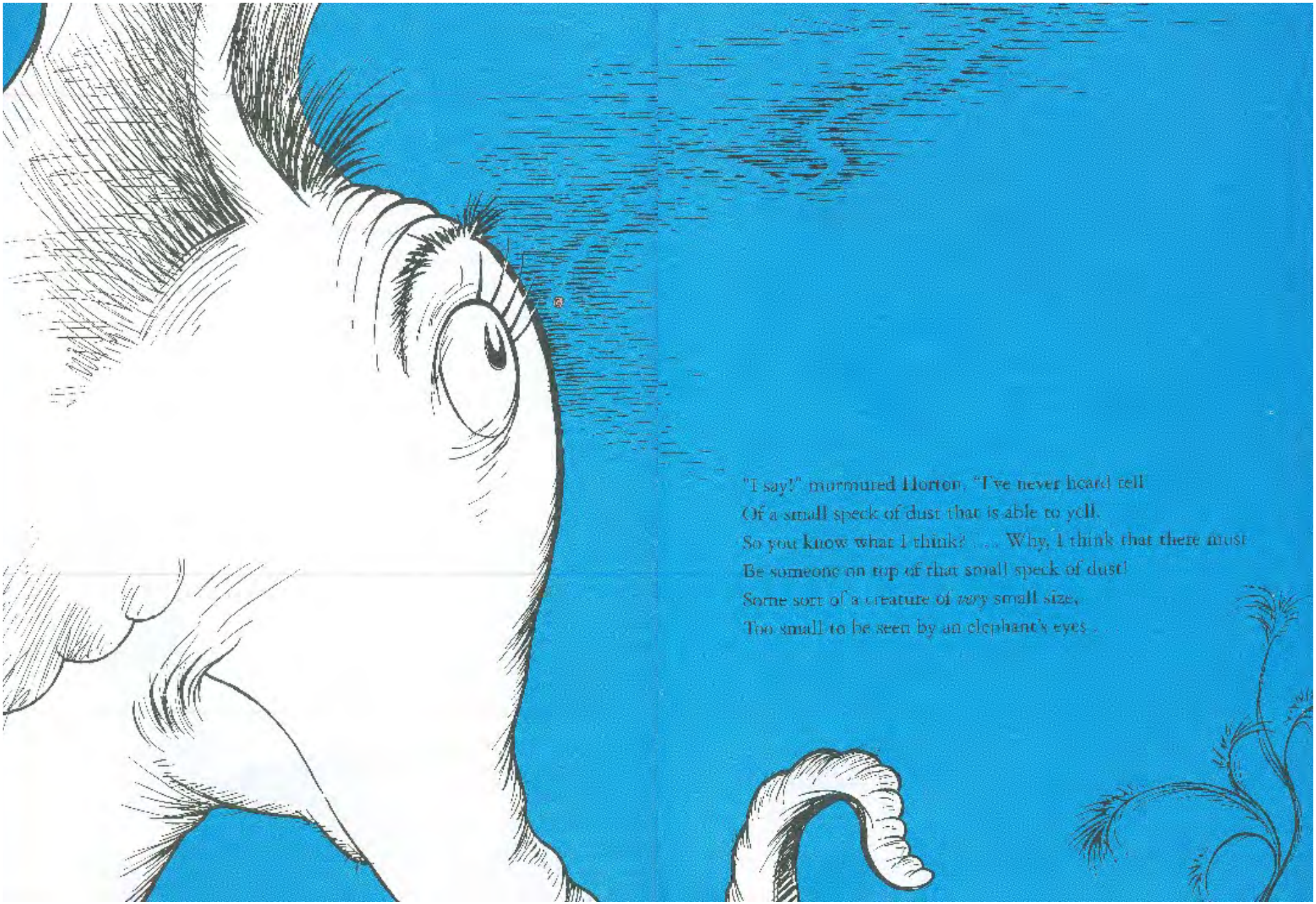




On the fifteenth of May, in the Jungle of Nool,
In the heat of the day, in the cool of the pool,
He was splashing . . . enjoying the jungle's great joys . .
When Horton the elephant heard a small noise.

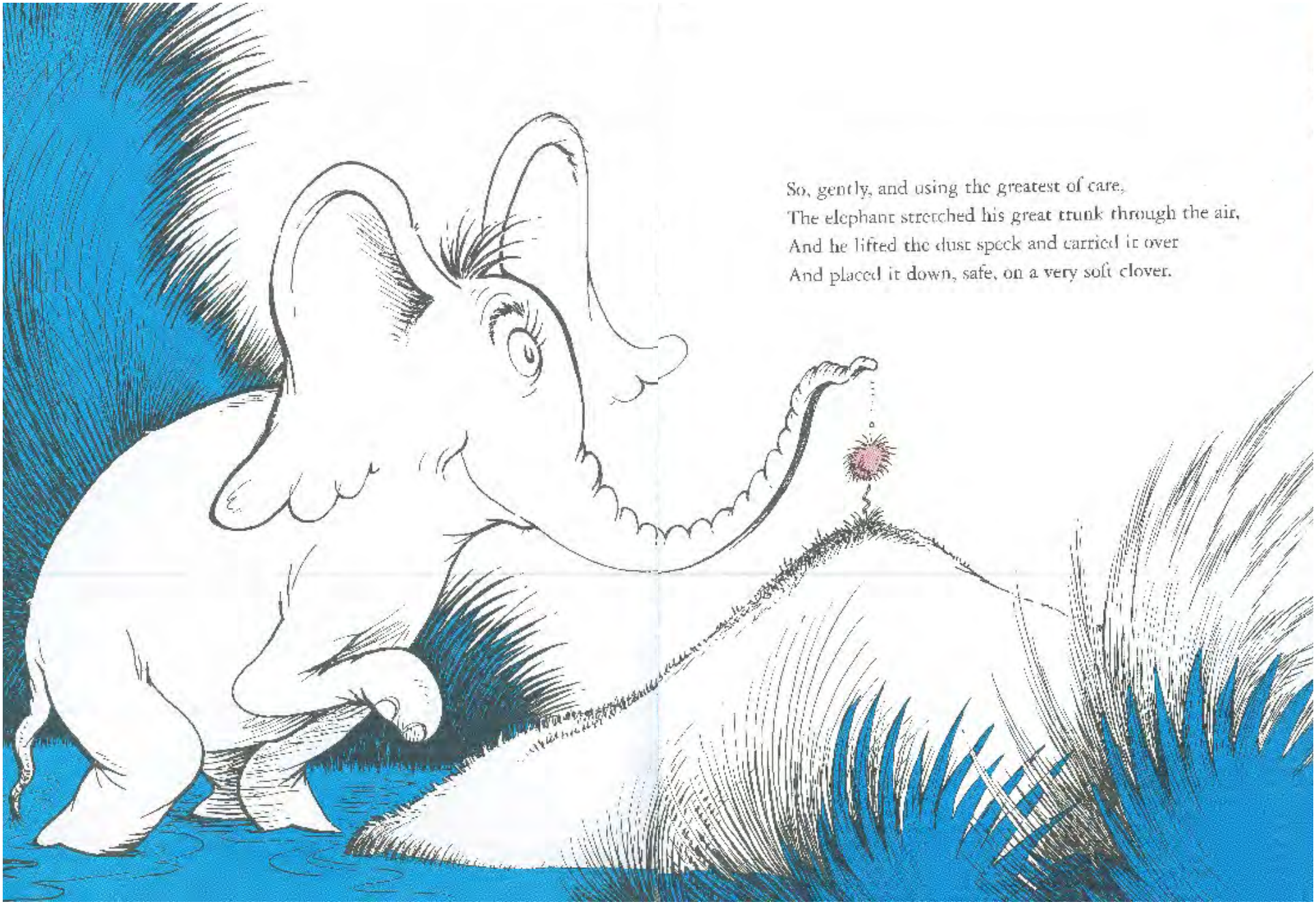


So Horton stopped splashing. He looked toward the sound.
"That's funny," thought Horton. "There's no one around."
Then he heard it again! Just a very faint yelp
As if some tiny person were calling for help.
"I'll help you," said Horton. "But *who* are you? *Where?*"
He looked and he looked. He could see nothing there
But a small speck of dust blowing past through the air.

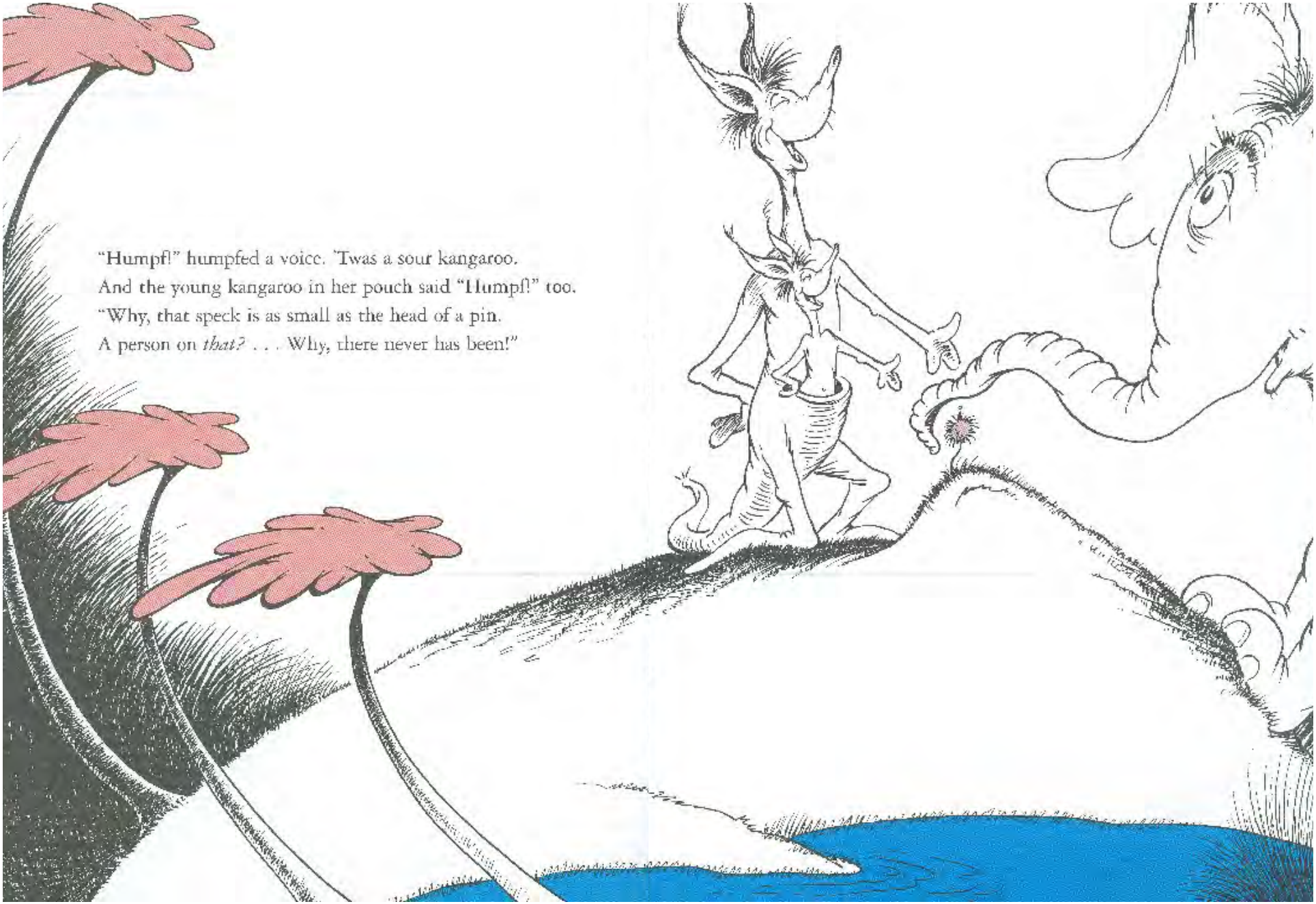


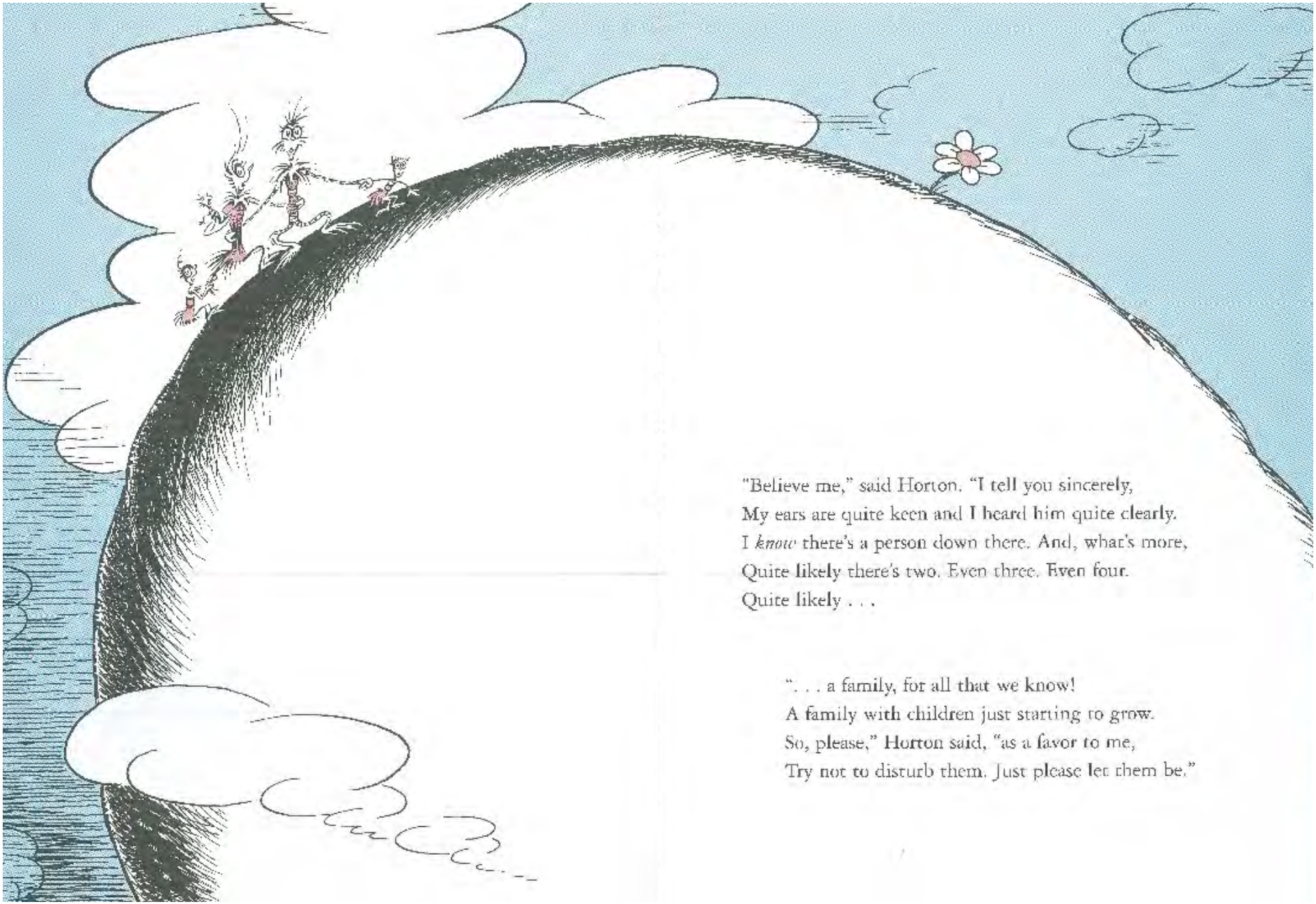
"I say!" murmured Horton. "I've never heard tell
Of a small speck of dust that is able to yell.
So you know what I think? . . . Why, I think that there must
Be someone on top of that small speck of dust!
Some sort of a creature of *very* small size,
Too small to be seen by an elephant's eyes . . .

". . . some poor little person who's shaking with fear
That he'll blow in the pool! He has no way to steer!
I'll just have to save him. Because, after all,
A person's a person, no matter how small."



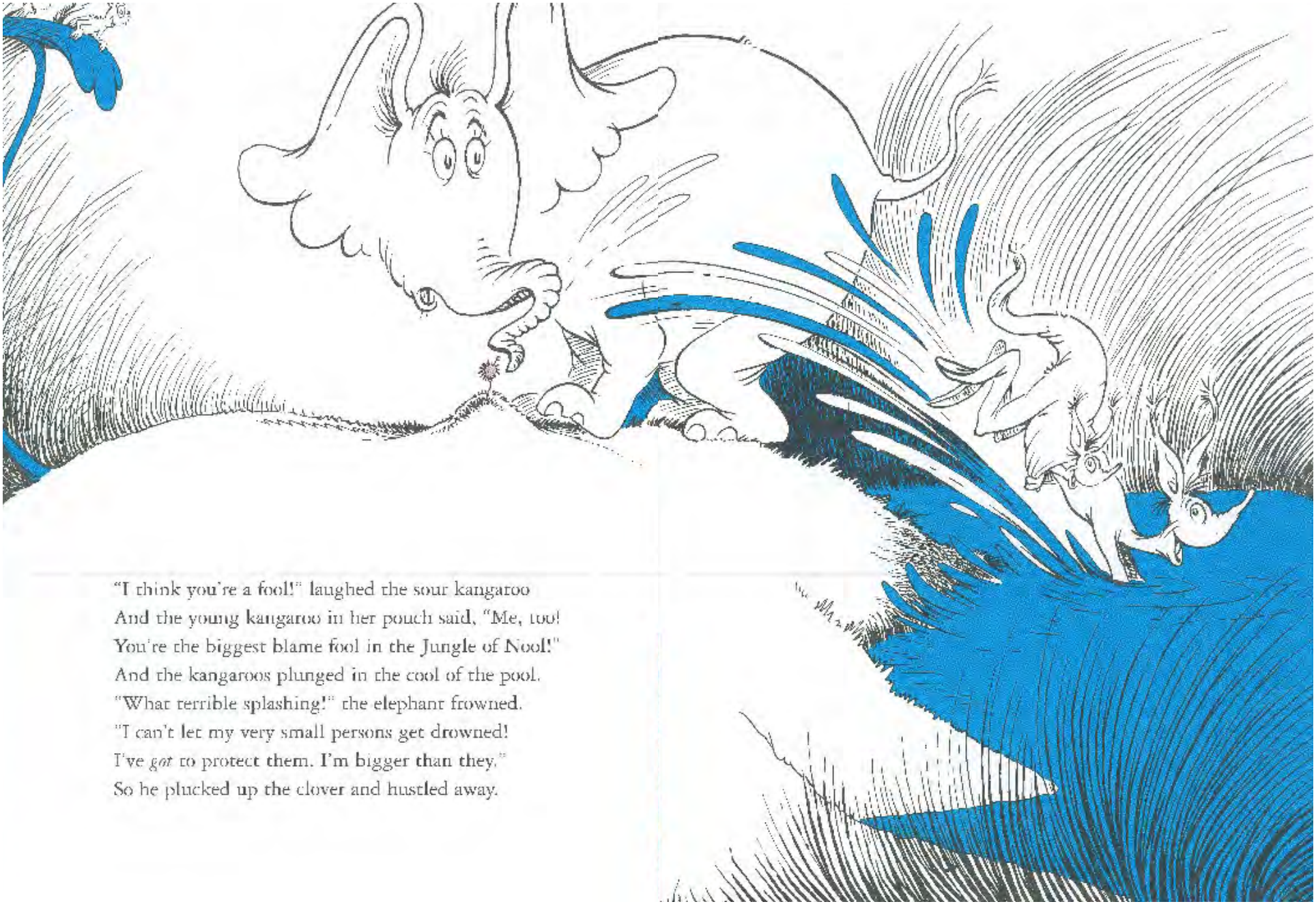
So, gently, and using the greatest of care,
The elephant stretched his great trunk through the air,
And he lifted the dust speck and carried it over
And placed it down, safe, on a very soft clover.


"Humpf!" humpfed a voice. 'Twas a sour kangaroo.
And the young kangaroo in her pouch said "Humpf!" too.
"Why, that speck is as small as the head of a pin.
A person on *that*? . . . Why, there never has been!"

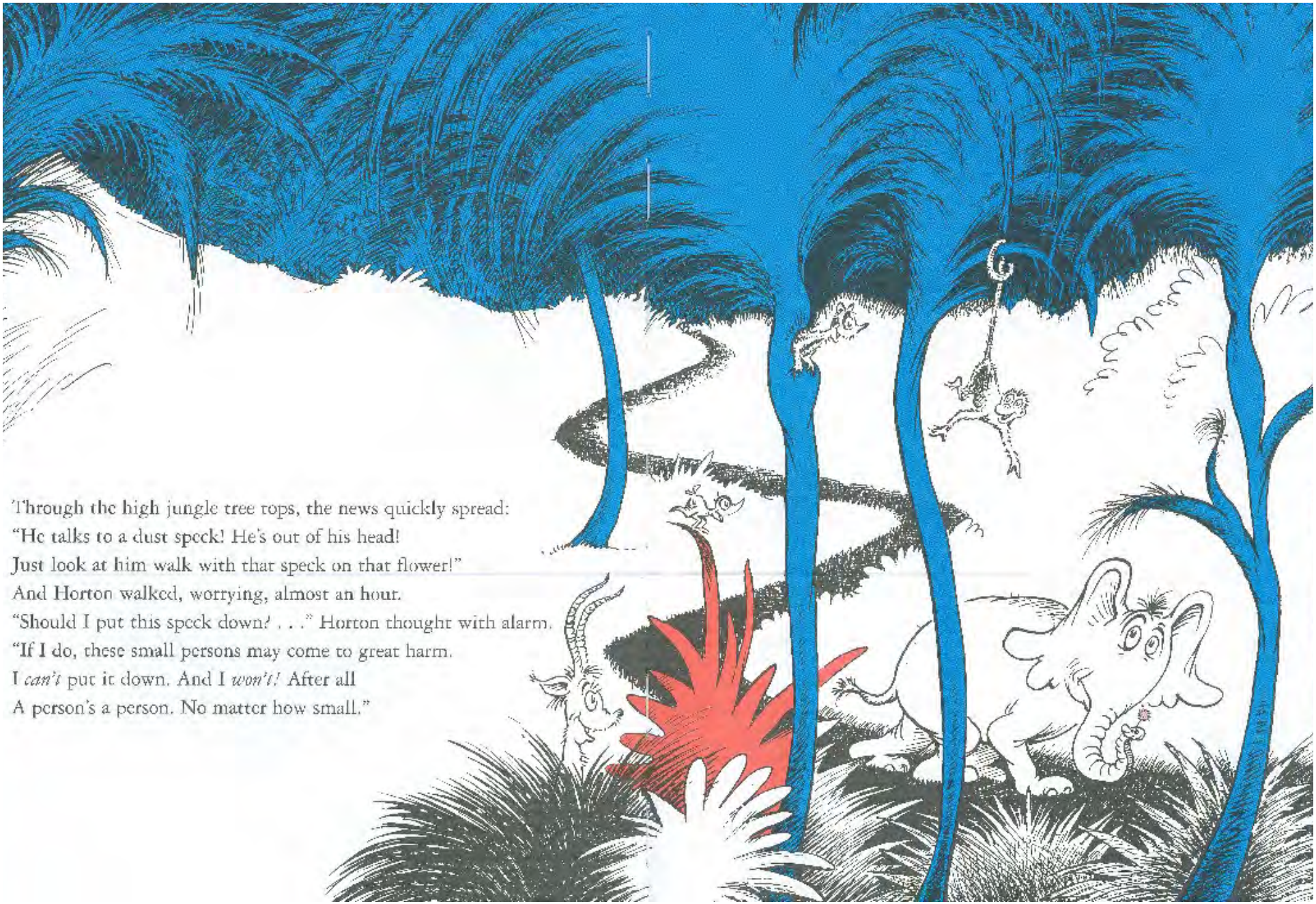


"Believe me," said Horton. "I tell you sincerely,
My ears are quite keen and I heard him quite clearly.
I *know* there's a person down there. And, what's more,
Quite likely there's two. Even three. Even four.
Quite likely . . .

". . . a family, for all that we know!
A family with children just starting to grow.
So, please," Horton said, "as a favor to me,
Try not to disturb them. Just please let them be."



"I think you're a fool!" laughed the sour kangaroo
And the young kangaroo in her pouch said, "Me, too!
You're the biggest blame fool in the Jungle of Nool!"
And the kangaroos plunged in the cool of the pool.
"What terrible splashing!" the elephant frowned.
"I can't let my very small persons get drowned!
I've *got* to protect them. I'm bigger than they."
So he plucked up the clover and hustled away.



Through the high jungle tree tops, the news quickly spread:
"He talks to a dust speck! He's out of his head!
Just look at him walk with that speck on that flower!"
And Horton walked, worrying, almost an hour.
"Should I put this speck down? . . ." Horton thought with alarm.
"If I do, these small persons may come to great harm.
I *can't* put it down. And I *won't!* After all
A person's a person. No matter how small."

# Engaging Bilingual Audiences

## Hosted by Children's Museum of Houston


Paul Freiling
Saint Louis Science Center
pfreilin@slsc.org
www.slsc.org

NISE network

# Meeting Goals

To inspire confidence and build capacity for partners to engage bilingual audiences in nanoscale science.

As a result professionals will…

- Develop a rationale for engaging bilingual audiences
- Learn about available tools and develop strategies to better engage bilingual audiences
- Connect with other professionals engaged in bilingual work
- Identify opportunities for action and implementation

NISE network

# Children's Museum of Houston Signage and Staff

- 100% of all exhibit text is English/Spanish bilingual
- 45% of Museum's public contact staff is English-Spanish bilingual including staff who manage and facilitate outreach programs
- 20% of Museum's Parent Resource Library collection is in Spanish
- Each of the Museum's 13 English-Spanish bilingual Family Learning Guides contain on average 50 pages of activities that families can do together at home to help children build academic skills and knowledge

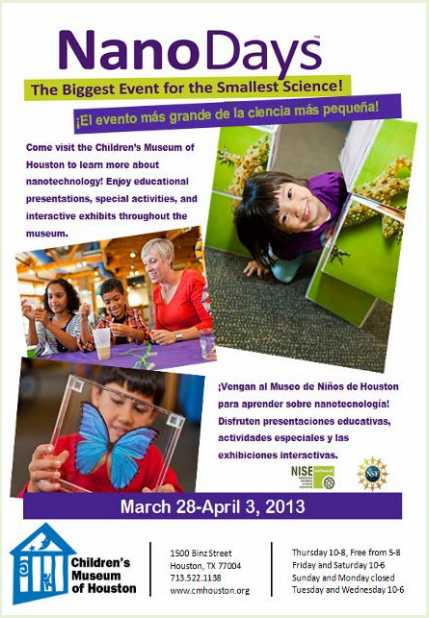
# Bilingual Story Times

- Story times every Thursday at 5, 6, and 7pm
- Audience is engaged in upbeat songs and dance before story is read
- Each child receives a free book of their choosing after the reading
- A number of "regular" visitors return every week

# NanoDays at CMH

- Bilingual Activities throughout Museum
- Bilingual Museum Nano signs posted throughout Museum
- Bilingual flyers handed out at outreach events weeks before






NISE network

# Sheltered Instruction

**What is it?**

- Instructional approach to engage English Language Learners above a beginner level in grade level content knowledge.

**Sheltered Instruction Strategies:**

- Speak clearly and slowly
- Use clear and simple language
- Use visuals and model/act out the activities
- Ask questions that require 1-2 word responses
- List and review instructions step by step
- Simplify language, not content

NISE network

# Sheltered Instruction – Nano Activity

## Exploring Properties—Surface Area

### Try this!

1. Pour 20 ml of colored water from the pitcher into each measuring cup.
2. Remove two antacid tablets from their wrapper. Break one in half, and drop it into a cylinder. Break the other tablet into many small pieces, and put it in the other cylinder.
3. At the same time, pour the water from each cup into a cylinder.
4. Which fizzes up faster, the tablet you broke in half or the tablet you broke into lots of pieces?

Do this while you are talking:

1. Mime the act of pouring water into the cup and point to the 20 ml line.
2. Mime breaking the first tablet in half and point to the sample. Then mime the act of breaking the second tablet into many pieces and point to that sample.
3. Pretend to pick up both cups at once and pour them into the cylinders. After they pour, crouch down next to the table with your eyes near table height and motion them to join you quickly. Use your fingers to follow the rising levels of bubbles and fluid in each cylinder.
4. Shrug your shoulders.

NISE network

# Saint Louis Science Center

## Cultural Events and Community Partnerships


# Society of Hispanic Professional Engineers (SHPE)

A partnership focused on connecting the SLSC more deeply with the St. Louis area Hispanic community.

# North American Taiwanese Engineers Association (NATEA) Symposium

A one-day public symposium on renewable energy and sustainable living. The symposium provided an opportunity for NATEA to share scientific information with public audiences, and gave an opportunity for visitors to talk with local scientists.

# FIRST Robotics
# International Friendship Day

An event that brings together International FIRST robotics teams competing in the FIRST Robotics Championships with St. Louis area robotics teams.

# Cultural Events and Community Partnership Successes

- Increased relevance to local and international communities
- Increased public and institutional awareness and understanding of cultural communities located in the St. Louis area
- Community and School Outreach support

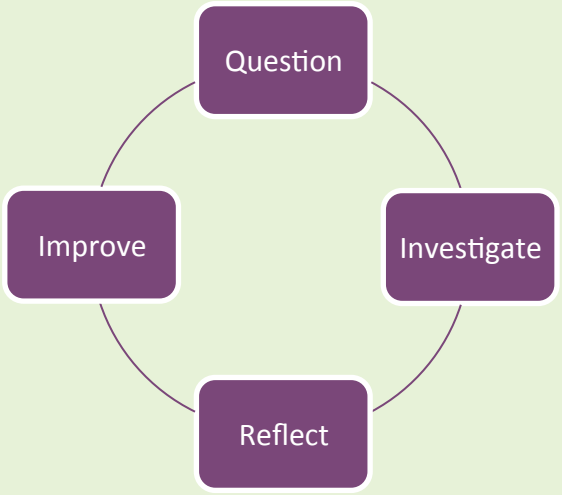
# Children's Discovery Museum
# Bethany Thomas


NISE network
NANOSCALE INFORMAL SCIENCE EDUCATION

NSF

Regional Meeting
October 2013

# Universal Design & Team-Based Inquiry




**Question**: How can this activity be improved to be more accessible for individuals with disabilities?

**Investigate**: We demonstrated our activity for different panelists for review and gathered feedback on what we could improve.

**Reflect**: As a group, we discussed and analyzed the feedback and looked for repeated patterns

**Improve**: We chose 1 or 2 barriers or challenges that stood out from the feedback and brainstormed and implemented ways we could improve the activity

# Universal Design
# Mitten Challenge - Original

**Try this**!
1.Put on a pair of oven mitts.
2.Try to build a house out of the bricks, like the one shown in the picture. Or build an idea of your own using the bricks.)
3.Now try building without the mitts.  Is it easier or harder?

**What's going on?**
It's difficult to build small things if your tools are too big! Your fingers are just the right size for building with toy bricks. Oven mitts cover your fingers and make your hands bigger, so you can't work as easily or precisely wearing them. Like everyone else, scientists and engineers need the right size tools for the job.
In the field of nanotechnology, researchers study and make tiny things that are measured in nanometers. A nanometer is a billionth of a meter. That's very, very small—the size of atoms and molecules, the building blocks that make up everything in our world.
Moving atoms around with regular tools is kind of like trying to build something out of toy bricks with oven mitts on your hands! As the new field of nanotechnology develops, we may be able to use atoms and molecules just like building blocks, putting them together easily to create tiny structures and machines.

**How is this nano?**
Scientists use special tools and equipment to work on the nanoscale.  Nanoscale science focuses on things that are measured in nanometers, including atoms and molecules, the basic building blocks of our world.
In the field of nanotechnology, researchers study and make tiny things that are measured in nanometers.  (A nanometer is a billionth of a meter.) Nanotechnology allows them to make things like smaller, faster computer chips and new medicines to treat diseases like cancer.

# UD Investigative Questions

1. What elements of the activity do you think are the most helpful for visitors with varying disabilities?
2. What elements of the activity do you think will prevent people with varying disabilities from fully engaging as intended?
3. What are possible solutions that could be used to eliminate those barriers?
4. Other notes:

# Universal Design Panelists Feedback

**1. What elements of the activity do you think are the most helpful for visitors with varying disabilities?**

- Explanation from presenter – good detail on shape, size, etc.
- It's a tactile activity using fairly large objects to manipulate
- Presenter spoke directly to panelist

- No scents or bright lights and sounds
- Gesturing and pointing to visuals for reinforcement good
- Having written information to read

# Universal Design Panelists Feedback

**2. What elements of the activity do you think will prevent people with varying disabilities from fully engaging as intended?**

•Tools are an extension of hands not just covering the hands

•Simulates inability to use hands which makes someone with a hand disability uncomfortable; Don't like putting things on hands (tactilely offensive)

•Kids that are clumsy might not want to do activity because of embarrassment

•Kids could get frustrated

# Universal Design Panelists Feedback

There was a time when I only survived because I made myself write out three pages of words in the morning. Pen to paper: no coming up for air until there were three full pages, and don't you dare read them, no. No re-reading until at least a month has gone by. The whole idea came from Julie Cameron and her Artist's Way book. I never really got past the first or second chapter, but they sure served me well. Well that survival may have been mostly just an emotional one, but still, I survived. I was the wreck of the Titanic. My grandma taught me that phrase. I should call her. Some days I pull out those old survival pages and re-read them. I laugh at myself. I say, "hmmmm." I say, "I'm glad I made myself articulate those days." And then I stuff them back into the old manila envelope where I stack them, three pages by three. And I wonder, where were those words before I wrote them all down? Maybe they were crouched behind walls of tears, or hiding behind walls of jealousy. Maybe they were shaking hands with old memories, and trying to teach them some earlier unimpressive breakdance moves. I'm not certain. It just always felt better to write them down. Some days it had the effect of standing on the edge of an organic cliff and screaming for ten minutes. Other days I could hardly see through my tears, and snotted all over the page. Some days I had to write, "blah blah blah I don't know what to write about this morning" six lines before I realized I had six pages of things to dislodge in my mind. I have friends who don't care for words. And I have friends who are enamored by them. I have friends who treat them cheaply. I have friends who don't know how well they play with them. And I have friends who have so many words locked up in them. I think that there is a lot more most of us need to say. But we're not sure if there's enough time to let the children out to play. We're not sure if our neighbor is safe enough to watch them, yet. Maybe tomorrow, we say. I think a wise old man once said that there is time for words and there is a time for silence, or something like that. A time for war and a time and for peace, a time to embrace and a time to refrain. I think that's the one. I like that in the beginning, there was the Word. I think I underestimate how much of a wordsmith God really is.

**Question 2 continued:**

- Use a model of the house not just a photo so non-sighted individuals can touch the object to get an idea
- Too difficult for multiple disabilities; individuals with hand disabilities cannot be fully engaged, only verbally
- Too much information to read at one time
- Very hard to fully engage hearing disabled individuals without an interpreter

# Universal Design Panelists Feedback

**3. What are possible solutions that could be used to eliminate those barriers?**

- Use clamps or grasping device instead of mitts
- Work in pairs to help one another
- Use a model of the house not just a picture
- Use the back of individual's hand to draw shapes of legos
- Make sure to describe shapes of legos not just size (square, rectangle; large, small)
- Use bigger blocks, simple designs and models

# Universal Design Panelists Feedback

**Question 3 continued:**

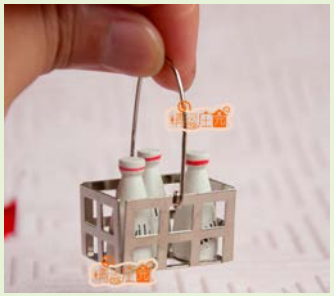
•Use a variety of tools instead of mitts like salad tongs, tweezers, chopsticks, etc.

•Allow individuals to select the complexity of the design and tools which allows them to build on experience


•Provide a Q&A sheet  from previous experinces

•Break the information and instructions into chunks

# Universal Design Panelists Feedback



**Other notes:**

- Some didn't like the activity at all
- Anxiety-induced activity; frustrating
- Make sure to include lots of visuals in speech as well as aides (red is hot; blue is cold)
- Think of different real world connections to illustrate an activity (dollhouse scale vs. regular scale; microsurgery)
- Some individuals with hand disabilities can't even put on the mitts so use different materials for different disabilities

# Universal Design Panelists Feedback

**Other notes continued:**

- Don't force visitors to participate
- Demonstrate first, then let them try it
- Model of 1 billion
- Ask if they'd like to do it on their own or if they'd like to do it together – make sure to ask at the beginning so not to imply doing it incorrectly
- Use bullet points or flashcards with vocabulary and steps; more pictures

**Nano =**
**Very, very small**

# Universal Design Reflection

**Identify patterns in the panelists' feedback**

- *Requires Dexterity* – need more models of the house with different complexities

- *Too much like a disability* – frustration with doing the activity; couldn't physically put on

- *Gloves are a problem* – not accurate; specialized tools like tongs and tweezers should be used

- *Good instructions* – keep explanations short and to the point

- *Good tactile objects* – large objects to manipulate

# Universal Design Improvements

Challenge #1: Frustration of not being able to do the activity

- Add a physical, tactile model of the house
- Choice of complexity
- Choice of tools

Challenge #2: Confusing Conceptually

- Provide real-life tools and connections
- Use the right tool for the job (example little screwdriver for little screw vs. large screwdriver for large screw)
- Break up text/information into components
- Add a whiteboard for additional communication

# Universal Design
# Mitten Challenge – Revised

1. Choice of Complexity – beginner, intermediate and advanced experiences

2. Choice of Tools right for the job – tongs with large wooden blocks; chopsticks or tweezers with sugar cubes

3. Photos of real-life connections – photo of clean room & equipment; microsurgery; crane moving oversized objects

4. Small bits of information – one page per concept or bullet points for instructions

# Universal Design Implementation

- Share Documents with Staff
- Review Activities in Innovation Station and make appropriate changes in accordance with Universal Design
- Incorporate Universal Design in Exhibit Development
- Discuss with Director training opportunities
- Bring in our own panelists
- Staff discussion about other programs we can incorporate universal design

# Universal Design Workshop

Peter Jacobsen

# Universal Design Overview

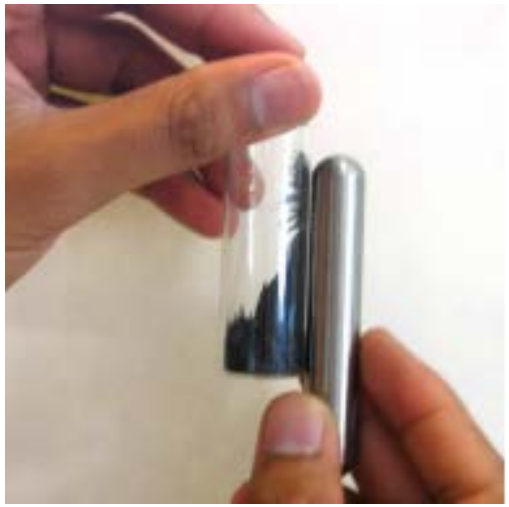
Main Concepts

1. Repeat and reinforce main ideas
2. Multiple entry points / ways of engagement
3. Physical and sensory access

**Universal Design is good for EVERYBODY in your audience!**

# Ferro Fluid

- Pros-
  - Demonstration is tactile, visual.
  - Magnets are engaging to many audiences.
  - Kit comes with written information which may aid the hearing impaired.

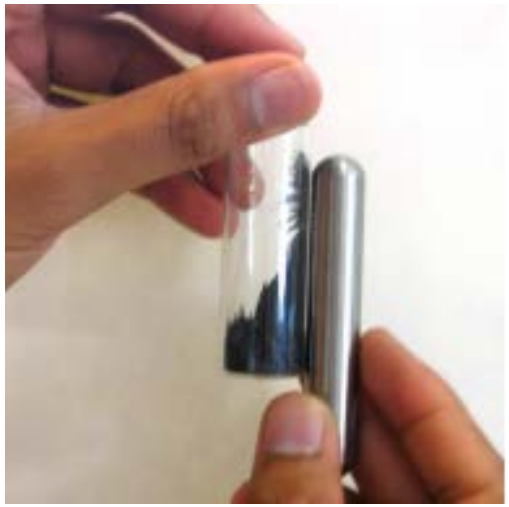


# Ferro Fluid

- Cons-
  - Magnets and test tubes are small and may be difficult for some visitors to manipulate.
  - Visually impaired visitors have no way of sensing what is occurring inside the liquid.
  - Information not tied to any common real life examples
  - Information sheet takes a few minutes to read and comprehend.

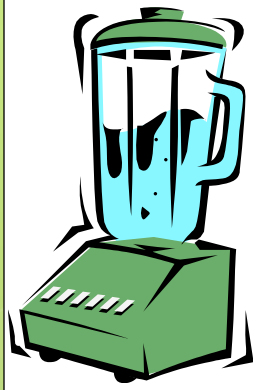
# Solutions

1. **Repeat and reinforce main ideas**
   - Decide on main point and repeat it throughout activity
     - "Materials can act differently when they are nanosize"
     - "Ferrofluid is a liquid, except when it is magnetized, it turns into a solid."
   - Signs and Labels on tubes to repeat and reinforce concepts



# Solutions

2. Multiple entry points / ways of engagement



- **Use real life examples and analogies.**
  - "If you blend ice down into small enough pieces in a blender it starts to act like a liquid. Kind of like what is happening here except the pieces of magnet are even smaller!"
  - "Have you ever seen anything else make a pattern like that on a magnet? "
- **Layer Content**
  - Have more detailed and technical content available for people interested in learning more.
  - Simple basic background content on magnets.

# Solutions

3. Physical and sensory access
   - Physical model of the spikey shape the fluid makes
   - Handles on magnets to make them easier to manipulate. Tubes made bigger or mounted on a board.
   - Break up info on sheet into bullet points or highlight important points to make it easier to comprehend quickly.
   - Supply other ways to feel or see magnetic fields and magnets.

# Duluth Children's Museum

- Good design for young children is nearly the same as Universal Design!
- Need to schedule enough project development time to make it happen.
- Pair nano kits together to supply multiple entry points to the same main idea.
- UMD student projects with the Nano Kits lead to new ways of using them.
- Evaluation and training.